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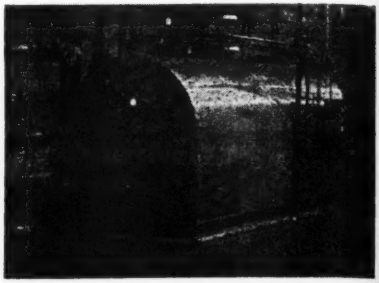

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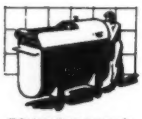

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QUARTERLY

of the

NATIONAL FIRE PROTECTION ASSOCIATION
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Tulsa Airport crash fire of Feb. 27, 1951. All 34 occupants escaped unassisted. No fire fighting was accomplished because crash truck bogged down in wet ground.

The Quarterly

Vol. 44 April, 1951 No. 4

Meeting of Board of Directors

New York, January 26, 1951

Present

A. H. S. Stead, President
Allen L. Cobb, Vice-President
T. Seddon Duke, Vice-President
Hovey T. Freeman, Secretary-Treasurer
John L. Wilds, Past President
Richard E. Vernor, Chairman

John H. Alderson
A. H. Baum
A. L. Brown
Hylton R. Brown
Loren S. Bush
J. E. Frederickson
John Kidde
Leonard C. Lund
R. D. MacDaniel
H. E. Newell
John A. Neale
George J. Richardson
W. A. Ross
W. W. Sampson
R. C. Sogge

Percy Bugbee, General Manager, Robert S. Moulton, Technical Secretary, Horatio Bond, Chief Engineer, Charles S. Morgan, Assistant to the General Manager, Charles L. Smith, Electrical Field Engineer.

Business Transacted

1. Plans for the 55th annual meeting in Detroit, May 7-11, were reviewed and the Program Committee was authorized to proceed in further development of the program along the lines outlined.

2. The prior action of the Board by letter ballot in deciding to meet in New York in 1952 was confirmed and the General Manager was authorized to complete hotel arrangements and establish the date for the meeting in either May or early June, depending upon the availability of suitable meeting facilities. Discussion by President Stead and others reflected the regret of the Board that it had not been possible to complete satisfactory arrangements for a meeting of the Association in Montreal or any other Canadian city in 1952 and the desire of the Board to schedule an annual meeting in Canada at the earliest convenient opportunity.

3. Treasurer Freeman reported on the finances of the Association indicating a healthy financial condition.

4. Executive Office reports were presented as follows:

(a) Membership—Mr. Bugbee.

(b) General Publications—Mr. Moulton.

(c) Advertising—Mr. Morgan.

(d) Firemen Magazine—Mr. Morgan.

(e) Pension Plan and Social Security—Mr. Bugbee.

(f) Flammable Liquids Field Engineering Project—Mr. Moulton.

(g) Electrical Field Service — Mr. Bugbee.

(h) Fire Prevention Week — Mr. Bugbee.

(i) Fire Marshals' Section — Mr. Morgan.

(j) Public Relations Department—Mr. Bugbee.

These reports were received with expressions of appreciation to the staff for their efficient conduct of NFPA affairs.

5. After discussion of regional meetings held in St. Paul and Dallas in the fall of 1950, with remarks by various members of the Board who had been present at one or both meetings and felt that these meetings were very much worth while, it was voted to authorize the staff to hold two regional meetings in the fall of 1951.

6. Mr. Bugbee reported on the progress of the Advertising Council campaign, with particular reference to the home fire prevention material distributed by the Advertising Council in October and sent to all NFPA members, also the material being distributed in February.

7. Chairman Cobb of the Industrial Committee reported on the developments in this committee, including the project of issuing a bulletin and plans for an industrial session at the 1951 annual meeting.

8. Messrs. Neale, Cobb and Moulton reported on the Society of Fire Protection Engineers, indicating that its organization had been launched as a section of the NFPA in accordance with previous authorization by the Board.

In conformity with the requirements of the regulations governing all NFPA sections that sections shall not solicit funds without approval by the Board, it was voted to approve the schedule of initiation fees and dues of the Society as determined at the organization meeting of the Society and to authorize the Society operating as a section of the NFPA to collect such funds and disburse them for the purposes of the Society, subject to further review and approval by the Board from time to time as the Board may determine. The schedule of initiation fees and dues as approved provides for an initiation fee of $15 for a member or associate member after May 1, 1952, $10 prior to that date, no initiation fee for juniors. The dues for members and associate members are $5 per annum in addition to NFPA dues, for juniors $2 in addition to NFPA dues.

9. There was a general discussion of the national emergency, with reports on the developments in civil defense by Mr. Bond and manpower and priorities by Mr. Duke and others.

10. (a) It was voted to confirm the action of the Board by letter ballot completed December 27, 1950, approving the 1951 National Electrical Code and submitting to the ASA for approval as American Standard. A communication from the National Electrical Manufacturers Association soliciting assistance from the Board in action on a proposed interim amendment was received and referred to the Electrical Correlating Committee. A communication from the Metals and Controls Corporation, Victor G. Vaughan, Executive Vice-President, was also received and referred to the Electrical Correlating Committee with a suggestion to Mr. Vaughan that the interim amendment procedure is available to him as a means for securing action on the situation about which he complains.

(b) The action of the Board by letter ballot in approving as an NFPA standard the provisions of the National Building Code as recommended by the National Board of Fire Underwriters on chimney construction was confirmed (this standard is published in the National Fire Codes, Vol. III, 1951).

(c) It was voted to confirm the action of the Board by letter ballot under which the 1950 edition of the Standards on Liquefied Petroleum Gases, No. 58, was published with the omission of Par. 611(d), which had been referred to the Board by action of the 1950 annual meeting of the Association. On recommendation of the Committee on Gases, as sub-

mitted by Chairman Newell of that committee, it was voted to approve a new text of Par. 611 (d) of these standards together with certain necessary editorial changes. (The detail of the revisions is published by the NFPA in *Fire News* for February 1951.)

(d) The action of the Board by letter ballot in approving the Social Security plan for members of the staff of the Association was confirmed.

11. Mr. A. L. Brown, Chairman of the Committee on Technical Committee Procedure, reported on developments in the field of this committee.

12. On recommendation of the Committee on Technical Committee Procedure, it was voted to confirm the appointments to committees made by the Committee on Technical Committee Procedure pursuant to the authority of the Board at its last meeting and printed in the 1950 Year Book, also the additional appointments submitted at the meeting.

13. A communication from the National Lumber Manufacturers Association protesting against NFPA sponsorship of the Committee on Building Code Requirements for Fire Protection and Fire Resistance, a sectional committee organized under the procedure of the American Standards Association, was received and it was voted to authorize the General Manager to take such action as he deemed appropriate concerning NFPA participation in this and related ASA projects.

Fire Hazards In 171 Missouri Hospitals

By Roy Hudenburg*

All registered hospitals in Missouri have now been inspected by the Missouri Inspection Bureau (NFPA Member) under the National Board of Fire Underwriters hospital inspection program. Reports on fire vulnerability have been issued under this program to 171 hospitals comprising 619 buildings and Paul W. Terry, General Manager of the Bureau, has kept a careful compilation of all fire hazards uncovered by his inspectors. Their principal findings are reported in this article.

The fire hazards range in severity from extremely minor hazards to others so severe that they can be attributed to ignorance of all ordinary safety precautions.

These particularly extreme hazards were reported in just two instances, and these, providentially, involved living quarters rather than patient areas. They consisted of the maintenance of personnel accommodations in combustible buildings provided with inadequate egress facilities and located over shop areas, which are considered to be areas of particular hazard.

How some of these conditions could have been created is difficult to comprehend, as for instance the two situations in which the inspectors found combustible stairways in otherwise fire-resistant build-

*Mr. Hudenburg is secretary of the American Hospital Association's Council on Hospital Planning and Plant Operation and is secretary of the NFPA Commitee on Hospital Operating Rooms. This article adapted from a report printed in "Hospitals" magazine for March 1951.

ings. Some items were particularly easy to cure, such as the two instances in which it was found that excess automobile parking interfered with the possible approach of the fire department apparatus. Other recommendations called for substantial remodeling, as for instance, the 166 hospitals which were advised to provide proper enclosures for stairways or elevators. In some cases the construction would entail the entire building of stairway enclosures, while in others only the addition of fireproof doors would be necessitated.

In all but seven of the 171 hospitals inspected, either there was no evacuation plan, or the plan was incomplete, or hospital personnel had not been drilled in steps to take in the event of fire.

Fortunately, while the development and administration of an evacuation program is a time-consuming addition to the administrator's other chores, it does not involve the investment of extra-budgetary funds.

Some of the hazards were particularly prevalent and consisted of conditions that added highly to the dangers of fire origin or rapid fire spread, as, for instance, the 39 hospitals in which highly volatile combustible substances were either improperly used or improperly stored, and the six hospitals found with oil-soaked wooden floors.

This description only highlights the listings provided below, which may be carefully studied in the nature of a check list and in which the type of hazard is fairly self-explanatory. The over-all findings, of course, must be studied in the light of the wide variety of hospital facilities contained in the state, including the state mental institutions. And consideration must be given to sub-standard rural facilities awaiting replacement under a program of Federal hospital construction grants (Hill-Burton Act), as well as to large and up-to-date hospital structures in metropolitan areas.

Following is a list of some of the hazards found in the 171 hospitals inspected in Missouri, arranged according to frequency of occurrence. Percentage figures indicate the percentage of the 171 hospitals in which each hazard was found to exist. A percentage figure of 95, for example, indicates that a hazard was found in 95 per cent of the 171 hospitals inspected.

Stairways and/or elevators not properly enclosed, including non-standard doors.	97%
No evacuation plan, or evacuation plan incomplete or not drilled.	96%
No emergency alarm system, or present alarm system inadequate or incomplete.	95%
Electrical defects, including overfusing, improper use of portable cords, defective or broken fixtures, no pilot lights, equipment not properly grounded, wiring not properly supported, and other miscellaneous defects.	95%
No emergency electrical power system, or present system inadequate or improperly arranged.	91%
Operating room construction, equipment and practices not in conformity with standards.	90%
Oxygen and/or nitrous oxide improperly stored or used.	81%
First-aid fire appliances, including standpipe and hose systems, insufficient or improperly maintained or installed.	78%
Exit doors open inward and/or locked.	78%
Adequate exit lights and signs not provided.	74%
Improper enclosures and/or improper doors or other nonstandard enclosure features of chutes, dumb waiters, waste and linen chutes.	62%
Automatic sprinklers not provided at top of chute.	61%
Egress facilities inadequate.	60%
Flammable liquids improperly used and/or stored.	57%
X-ray room apparently not properly lead shielded.	56%

Long corridors or undivided areas without smoke-stop partitions or provided with nonstandard or ineffective smoke-stop partitions. 53%

Combustible anesthetic agents improperly stored or used. 49%

Vent hoods and duct systems for kitchen cooking equipment not provided or not properly arranged. 46%

Major portion of hospital requiring automatic sprinkler protection because of height and/or size of building. 39%

Boiler or furnace rooms not adequately cut off, where size of building requires such cut-offs. 38%

Repair, service and maintenance shop areas not properly cut off or sprinklered. 38%

Hand rails and/or guard rails not provided where needed. 36%

Combustible draperies and/or curtains not properly flameproofed. 35%

Poor housekeeping conditions in any portion of the building. 33%

Combustible acoustical material. 30%

Exitways blocked or otherwise obstructed to prevent egress. 26%

Room doors and/or corridor doors or other openings not wide enough to permit passage of a bed. 25%

Furnace, boiler, heating, cooking, or smokepipe and vent pipe clearances not standard. 25%

Standard metal containers not provided for oily rags, waste and/or oily mops. 25%

Improper use and/or storage of highly volatile combustibles. 23%

Bunsen burner and other portable gas devices not equipped with shut-off valves, and/or set on combustible bases and/or having supply hose in poor condition. 21%

Storage of combustible material on or under stairway. 19%

Windows opening on to external fire escapes not properly protected, where building construction will require such protection. 17%

X-ray equipment not properly installed and/or grounded. 15%

Smoking in unsafe locations. 14%

Combustible sections of buildings used for storage or housing purposes requiring automatic sprinkler protection. 14%

Boiler and/or other pressure vessels not regularly inspected by competent inspectors. 13%

Fire department not familiar with hospital. 13%

Oil supply for boilers, furnaces or engines not properly arranged. 10%

Air-conditioning system or fan system not provided with adequate shut-off control. 10%

Adequate guards not provided for machinery or steam pipes. 10%

Improper storage of safety-type X-ray film. 10%

Tunnels communicating between sections of the premises not provided with effective smoke barriers. 9%

Locked room doors or corridor doors without adequate keys available (in mental institutions or sections only). 9%

Nonstandard clearance from laundry drying tumblers or drying vent pipes. 9%

No one on duty at all times who is familiar with the light and power system. 9%

Incinerators improperly constructed or located. 9%

Ventilating duct terminating in combustible attic or roof spaces. 9%

Broken ceiling or other concealed spaces (does not include shaft or chute communication). 9%

Miscellaneous unprotected vertical openings other than stairways, elevators and chutes (does not include broken ceilings). 9%

Fire escapes not extending to ground. 8%

Ammonia, or other toxic refrigeration equipment not contained in gas-tight rooms, when located in institutional buildings. 8%

Liquefied petroleum gas systems not properly installed. 6%

Heavy external exposure. 6%

Various elevator deficiencies, including lack of interlock, pitted contacts on controllers, incomplete car enclosures, worn cables. 6%

Gas-burning devices not properly vented. 6%

Elevator machinery room not properly cut off. 6%

Machinery interlocks not provided as needed. 6%

Nonstandard lint traps or no lint traps. 5%

Air-conditioning ducts not provided with shutters or fire doors where passing through fire walls or fire-resistive floors. 5%

Large-scale laundry areas not cut off from the remainder of the building.	4%
Oil-soaked wood floors.	4%
Waste paper, trash and refuse burned in open yard without adequate safeguard.	4%
Suitable gas masks not provided where toxic refrigerants are used.	4%
Nonstandard transformer vault. Both general electrical supply transformers.	4%
Nonstandard motion picture booth for projection of nitro-cellulose film.	4%
Clinkers and/or ashes placed in wood containers, against wood partitions or doors.	3%
Gas supply piping not properly installed.	3%
Poor repair of buildings used to house mental patients.	3%
General use of strike-anywhere matches.	3%
Insufficient gas shut-off valve.	2%
Gas valves and/or regulators corroded.	2%
Combustible driers in laundry.	2%
Wood shingle roof on hospital or auxiliary building.	2%
Cracked chimney.	2%
Poison not properly stored.	2%
Nonstandard storage of nitro-cellulose X-ray film.	2%
Windows off the stair landing not properly screened to prevent persons falling into them.	2%
Slippery surfacing on ramps.	2%
Stairways do not discharge directly to outside.	2%
Worn stair treads.	1%
Boilers not equipped with standard safety features.	1%
Bituminous coal, in large quantities, not properly stored.	1%
Nonstandard clearance from steam lines.	1%
Combustible air-conditioning ducts.	1%
Steam or heating pipes and/or radiators used for direct drying of combustible material.	1%
Excess auto parking interfering with possible fire department approach.	1%
Unscreened areaways.	1%
Automatic detection system provided but complete coverage not presently installed.	1%
Nonstandard location of gas meters and/or regulators.	1%
Ordinary glass skylights.	1%
Glass transoms over exit doors.	1%
Ramps not curbed.	1%
Combustible stairways in fire-resistive buildings.	1%
Metallic tubing on refrigerating equipment subject to mechanical injury.	1%
Deficient water supply to private yard hydrants.	1%
Kerosene lamps and candles used for emergency lighting.	1%
Living quarters, with inadequate egress facilities, located over shop areas in combustible buildings.	1%
Old style fire-resistive construction having large amounts of combustible interior partitions and finish, requiring automatic sprinkler protection.	*
Natural gas supply not odorized.	*
Combustible storage in yard areas adjoining hospitals.	*
Large frame dome not easily accessible for fire-fighting purposes.	*
Attic areas open to the outside with accumulations of rubbish apparently brought in by birds.	*
Home-made combustible dust mop cleaning machine.	*
Remove revolving type exit door.	*
Remove rolling type fire door on exitways.	*
Sorting and baling of trash in hospital buildings.	*
Storage of automobiles in hospital buildings.	*
Automatic features of fire doors not properly installed.	*
Wooden clothes lockers for employees.	*

*Indicates less than 1%.

Doin' Somethin' 'bout School Fires

By Carl S. Smalley*

Making fire safety everybody's business and yet, specifically, nobody's business proved disastrous for the Arkansas school system during the years 1944-1948. In this period the number of major school fires in the state jumped from 10 a year to 24, and it looked as though the cycle would spiral even higher.

The Arkansas State Fire Prevention Association, noting this threat to the State's school system, decided that some barriers would have to be erected to halt this destructive pattern if education in the state could continue to progress. They, accordingly, set about "doin' somethin' " and the result has been that during the school year 1949-1950 only 8 major fires occurred while during the first eight months of the current school year there have been only 4 fires where losses have exceeded $5,000.

Behind this accomplishment is one of the most dynamic, vital programs of its type that has been accomplished in the United States. The best part about it is that the kids themselves have done the major portion of the work. This would not have been possible unless the State Department of Education and the State Fire Marshal, with the help of the State Fire Prevention Association and the Arkansas Inspection and Rating Bureau, had been fully behind the program.

Imagine your boy being a Junior Fire Marshal. Imagine his inspecting your home for fire hazards. Imagine his going to school and making an inspection of the property to rid it of fire hazards. Imagine his asking his teacher about what causes fires and how fires spread. If you lived in Arkansas today, you wouldn't have to imagine these things because you would live them.

This is a photograph of a two-color badge prepared by the Public Relations Committee of the State Fire Prevention Association. Deputy Junior Fire Marshals have similar badges.

How many times has your boy had an opportunity to go to the State Capitol and visit with the Governor? Does your youngster know that there is such a person as a State Fire Marshal? Wouldn't you be impressed if your "income tax deduction" rode in a cavalcade escorted by police sirens and fire equipment down the main street of the Capitol?

The Junior Fire Marshals of Arkansas have met with Governor McMath, have

*Mr. Smalley is Chief of the Fire Prevention Division of the Arkansas Inspection and Rating Bureau and Executive Secretary of the Arkansas State Fire Prevention Association.

come to know Fire Marshal Bernard J. Reid personally, and have felt the tingling sensation of riding behind sirens when they have attended the annual picnic given by the sponsoring groups for their year's activities in school fire safety.

Combustible storage under the seats of assembly hall. Flammable vapors from liquids in open containers required photographer to use time exposure rather than flash bulb.

What Good Does the Program Do?

Take a look at the picture of the combustible storage found under the wooden seats of the school assembly building by one Junior Fire Marshal. In taking this picture the photographer was so afraid that flammable liquid vapors might be ignited by his flash-bulb that he resorted to a time exposure. And yet, before this condition was corrected, hundreds of youngsters sat on the wood seats in the assembly hall directly above. If you were an Arkansas parent, you would be particularly thankful that this condition was corrected.

Or take a look at the photo on the next page of the garage-like structure which was the industrial arts shop at one Arkansas high school before the Junior Fire Marshals did a fire prevention clean-up job. In this single area paint spraying and welding were performed simultaneously, and there were no safeguards to protect either the lives of the students or the structure in which the shop was housed. If these conditions existed in Arkansas, they might also exist in your home town!

If you think these are isolated examples, look at the other photos in this article showing the amount of combustible material stored in the attic of one of the school buildings inspected by the Junior Fire Marshals, and the storage shed that exposed a nice brick school at another location. It wouldn't be hard to visualize what would happen to the ordinary glass windows if this shed ignited in the middle of the night.

It was conditions like these that gave the state's schools such an unhappy fire record, but the clean-up job that was done wasn't done just once and then forgotten. It is a continuing program because the school boys themselves have been integrated into the program so that every new student becomes a fire preventionist and the janitor just doesn't have a chance!

Who's Behind the Program?

The adult organization behind all this progress makes very pleasant reading. The program was initiated by the State Department of Education and, at the start, was under the direction of men whose liveli-

View of junk storage in the attic of an Arkansas school building discovered by Junior Fire Marshals.

Industrial arts shop where paint spraying, welding and other hazardous work was carried on in the same area. Note gas cylinders, exposed wiring and unprotected light bulbs and lack of door in opening to left.

hood is directly associated with fire safety. The spark has caught, and now the State Department of Education is running the program on its own hook, leaning for technical knowledge and cooperation on the State Fire Prevention Association, the Arkansas Inspection and Rating Bureau, the State Fire Marshal and similar agencies.

The initial program started back in 1948, and was based on a six point approach. First of all, the State Department and its fire prevention experts wanted to make the school officials realize that they had a problem. The best way to do this was to draft a self-inspection blank and to tease the local school superintendent to complete it on a periodic schedule. Of course he needed some help to recognize a fire hazard when he saw it, and so the Rating Bureau and State Fire Prevention Association organized some of their personnel to be discussion leaders at regional school administrator's meetings. Since Mr. J. L. Taylor, Director, Division of School Administration, of the State Department of Education was behind this second phase of the program, these meetings of the school administrators were well attended and enthusiastically received.

But, since the superintendents of schools have several other small problems to handle, it was decided, as a third step, that perhaps one of the most effective ways to halt the rising fire loss trend was to reach the school custodians, or janitors. Once the superintendents had been stimulated, they saw to it that these custodians attended the district training meetings.

Obviously, however, the program also needed some top level organization within the school system of the state. As the Rating Bureau and Fire Prevention Associates traveled around the state for the purpose of meeting with the administrators and janitors, it became quite evident to them that many of the buildings were either built to burn or had definite hazards from a safety standpoint. The Department of Education was therefore approached with a recommendation that any plans of new

A typical group of school administrators at a regional fire safety meeting.

school buildings or additions to existing buildings be submitted for the approval of the Arkansas Inspection and Rating Bureau engineers prior to the letting of contracts for construction. In this fourth phase, the Department of Education saw how much easier it was to build a school safely in the first place than to try to protect an unsafe structure.

Because fires, fortunately, did not occur in every school every day, it was also found desirable, as a fifth approach, to prepare monthly fire prevention bulletins that would be sent out by the Department of Education to all school supervisors and custodians. In this way, a school fire that happened in Eldorado or Smackover became a matter of personal concern to the school officials in Jonesboro, in the direct opposite corner of the state. These monthly bulletins not only reported that a fire occurred, but told why it occurred, how it spread, and what the damage was. Unfortunately, the newspapers do not give this type of information, but with these monthly bulletins the school administrators came to realize how frequently common sense fire prevention measures were violated.

An additional step taken in the initial program was to combine the loss reports of all school fires so that the magnitude of the individual hazards would be in proper proportion in the overall picture. One such bulletin, for instance, showed that 4 gymnasium fires occurred during the night in Arkansas schools during one year just because janitors did not remove cigarette butts after a sports event.

How It Has Grown

This whole program may sound relatively simple, but when you have 421 school districts containing more than 4700 school buildings and are also dealing with 75 county superintendents, it can be readily observed that no simple "one-shot" effort would do the job. Repeated efforts were necessary, and letters, bulletins and such material as the article that appeared in *Collier's* magazine on October 2, 1948, entitled "Death in the Classroom" were sent to the key personnel at regular intervals. The self-inspection forms at first were completed by only 196 of the 421 school districts, and while the Committee felt that this was a fair percentage because the program was new and on a voluntary basis, they saw from this result that they had not awakened the genuine interest of each and every school superintendent. During this year, however, the number of

Note the proximity of this storage shed to the unprotected windows of the school. The cans in the foreground were open paint cans and oily rags were found on the top of the mixing container.

major fires in Arkansas schools dropped from 24 to 11, and so, in the fall of 1949, the Committee was enlarged to include the State Firemen's Association and the Boiler Inspection Division of the State Labor Department. These new members afforded the program state-wide assistance from the municipal fire departments and also expert advice and inspection service on all gas installations in school heating plants.

The enlarged group adopted the name "Arkansas School Fire Safety Committee" and set about organizing the whole program somewhat more formally than previously. It is from this Committee that a coordinated program has been organized and developed. The state agencies (including the State Department of Education and the State Fire Marshal) now had a formal membership on the Committee along with the other fire safety organizations. From this group came the idea of a state-wide "Junior Fire Marshal's Organization" which today has a membership of 225 Junior Fire Marshals and 440 Deputies, selected from students of the junior and senior classes of the high schools.

Every Boy Wants to Be a Marshal

Competition for the honor to become a Junior Fire Marshal is very keen and this is one secret in the success of the plan. Each school district has only one Marshal. This Marshal has a Deputy for each school building within the district. The Junior Fire Marshals are given fire prevention training by the representatives of the State Fire Prevention Association and the Arkansas Inspection and Rating Bureau in regional meetings. The organization chart published on the following page helps to visualize the overall plan. The importance of the subject of fire prevention was, of course, not appreciated by all the boys

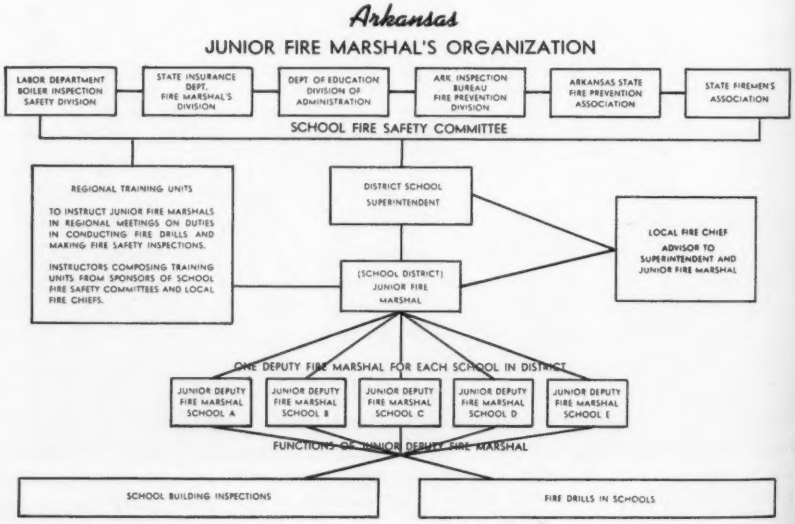
Members of the first Junior Fire Marshals class are being told the importance of their work by Governor Sid McMath in the Governor's reception room at the State Capitol.

selected for the Junior Fire Marshal job. Undoubtedly, many did not attach any more importance to the subject than the general public who have exhibited through the years their contempt for learning fire safety as proved by the staggering national fire waste. It was apparent that something should be done to make the appointment of Junior Fire Marshal more than an empty honor.

Enjoying the cooperation of the State authorities previously cited, the Committee reached for and secured the highest level of State endorsement for the program. Particularly gratifying was the personal attention given by Governor Sid McMath who addressed the First Annual State Convention of Junior Fire Marshals held in Little Rock on April 20, 1950.

How do these Junior Fire Marshals function? The planners realized that the success of their program in each local school depended upon securing the right boy for the job, giving him the necessary training so that he would be effective, securing for him the recognition and respect he should have among the other students, and assuring that the principal's office was not only intimately informed of his activities but also gave him full cooperation.

The State Department of Education instructed the local superintendents to select or elect the Junior Fire Marshal from a member of the two top grades in high school who would work directly through the principal's office. The training of the Junior Fire Marshals, as explained before, would be done by the state-wide committee but the training of the Deputies would, in turn, be accomplished by the local Junior Fire Marshal and a committee selected by him and his principal. The local Fire Chief has been called upon by the State Firemen's Association to be the key man in this "on-the-spot" training, much to the delight and prestige of the Junior Fire Marshals.


Arkansas
JUNIOR FIRE MARSHAL'S ORGANIZATION
LABOR DEPARTMENT BOILER INSPECTION SAFETY DIVISION
STATE INSURANCE DEPT. FIRE MARSHAL'S DIVISION
DEPT OF EDUCATION DIVISION OF ADMINISTRATION
ARK INSPECTION BUREAU FIRE PREVENTION DIVISION
ARKANSAS STATE FIRE PREVENTION ASSOCIATION
STATE FIREMEN'S ASSOCIATION
SCHOOL FIRE SAFETY COMMITTEE
REGIONAL TRAINING UNITS
TO INSTRUCT JUNIOR FIRE MARSHALS IN REGIONAL MEETINGS ON DUTIES IN CONDUCTING FIRE DRILLS AND MAKING FIRE SAFETY INSPECTIONS.
INSTRUCTORS COMPOSING TRAINING UNITS FROM SPONSORS OF SCHOOL FIRE SAFETY COMMITTEES AND LOCAL FIRE CHIEFS.
DISTRICT SCHOOL SUPERINTENDENT
(SCHOOL DISTRICT) JUNIOR FIRE MARSHAL
LOCAL FIRE CHIEF ADVISOR TO SUPERINTENDENT AND JUNIOR FIRE MARSHAL
ONE DEPUTY FIRE MARSHAL FOR EACH SCHOOL IN DISTRICT
JUNIOR DEPUTY FIRE MARSHAL SCHOOL A
JUNIOR DEPUTY FIRE MARSHAL SCHOOL B
JUNIOR DEPUTY FIRE MARSHAL SCHOOL C
JUNIOR DEPUTY FIRE MARSHAL SCHOOL D
JUNIOR DEPUTY FIRE MARSHAL SCHOOL E
FUNCTIONS OF JUNIOR DEPUTY FIRE MARSHAL
SCHOOL BUILDING INSPECTIONS
FIRE DRILLS IN SCHOOLS

State Fire Marshal B. J. Reed (right center with file under arm) with Junior Fire Marshals at a regional conference.

Regional Conferences

When the Junior Fire Marshals meet in regional conferences for their one-day training sessions, they have an opportunity to see how they fit into the state program. The following subjects were covered at the 1950 regional training conferences:

Purpose of conference and objectives of Junior Fire Marshal Program.

Discovering and removing school fire hazards.

Discussion of the official Fire Prevention Recommendations Manual (This Manual is the "Fire Prevention Recommendations" published by the Western Actuarial Bureau.)

Field trip to inspect a local school under the supervision of experienced inspectors.

Discussion of hazards found in the local school.

Discussion of hazards found in their own school buildings.

Duties of the Junior Fire Marshal.

Demonstrations of fire extinguishers.

Presentation of credentials.

Of course, the Committee did not expect such one-day programs to make professional fire-safety inspectors out of untrained youths. But they did feel that the fundamentals could be taught. Their faith in the program has already been more than justified.

The Junior Fire Marshals, in practice, act as administrative assistants to the school superintendents. They are charged with the responsibility of inspecting their respective schools. They aid in the training of their "Deputy" Fire Marshals, with the assistance of their adult local Fire Chief. They assist and encourage their contemporaries in properly executing school fire drills. They make their monthly reports to the State Fire Marshal's Office in Little Rock and to the Arkansas Fire Prevention Association. This report is signed jointly by the Junior Fire Marshal and the Superintendent. As an incentive to the boys, badges were designed by the State Fire Prevention Association's Public Relations Committee, and the State Fire Marshal issues personally signed identification cards which are presented at the close of each training conference after an oath has been administered in a formal ceremony befitting the seriousness of the occasion. Newspaper releases to all home town papers are also prepared by the Committee giving the name of the local Junior Fire Marshal, and because these are carefully prepared, considerable space is devoted to the release by the local editors.

How the Local Fire Department Helps

When the local Fire Departments started to make home-town Junior Fire Marshals honorary members of their Department, the competition to become a Junior Fire Marshal was greatly heightened. In some towns, the Fire Chief was able to obtain passes to the local motion picture theatres for these Junior Fire Marshals and their Deputies, and this act also multiplied the eagerness of the boys to secure the honor. At the First Annual State Convention in Little Rock, state officers were elected among the representa-

tives and this has stimulated keen competition among the Marshals to do the best possible job in their respective schools.

But all has not been work. At the Annual State Convention the Junior Marshals were taken by cars to Boyle Park with an escort of police, sirens and all. At the park they had a grand feed and spent the afternoon playing games and being entertained by a National Guard Band. All of this, and all of the expenses of the rest of the program, have been donated by public spirited individuals and companies in the state, particularly by insurance agents and fire protection equipment manufacturers and distributors.

Look At the Results

The results have been truly significant. At the close of last school year (1949-1950) a 27% reduction had been accomplished in the number of major school fires in the state. During the present school year, the number of Junior Fire Marshals and Junior Deputies has increased 32% and in the first eight months of the current year, Arkansas sustained only four fires with a loss exceeding $5,000 out of 4,789 school buildings in the state. None of these fires occurred in a school district having a Junior Fire Marshal.

They sure are doin' somethin' 'bout school fires down Arkansas way and it sure ain't just anybody's business any more!

HELP For The Teacher!

The foregoing article on "Doin' Somethin' 'bout School Fires" tells how Arkansas has met the problem constructively. But, thanks to the National Education Association, we today have help for the teachers of all our schools, elementary to high school grades, on fire safety instruction.

NEA's Fire Safety Series, No. 1, for Teachers of Primary Grades, offers suggestions for making fire safety a logical part of the learning experiences of young children. Headlining the main features as "Play, Participation and Practice," the NEA suggests to teachers that children can be taught fire lessons by these three methods, all so common in elementary schools. Integrating fire safety into elementary social studies, languages, mathematics, arts and crafts, science and health education is suggested and the experimental efforts completed by schools which developed the project are shown in photographs in the 24-page booklet.

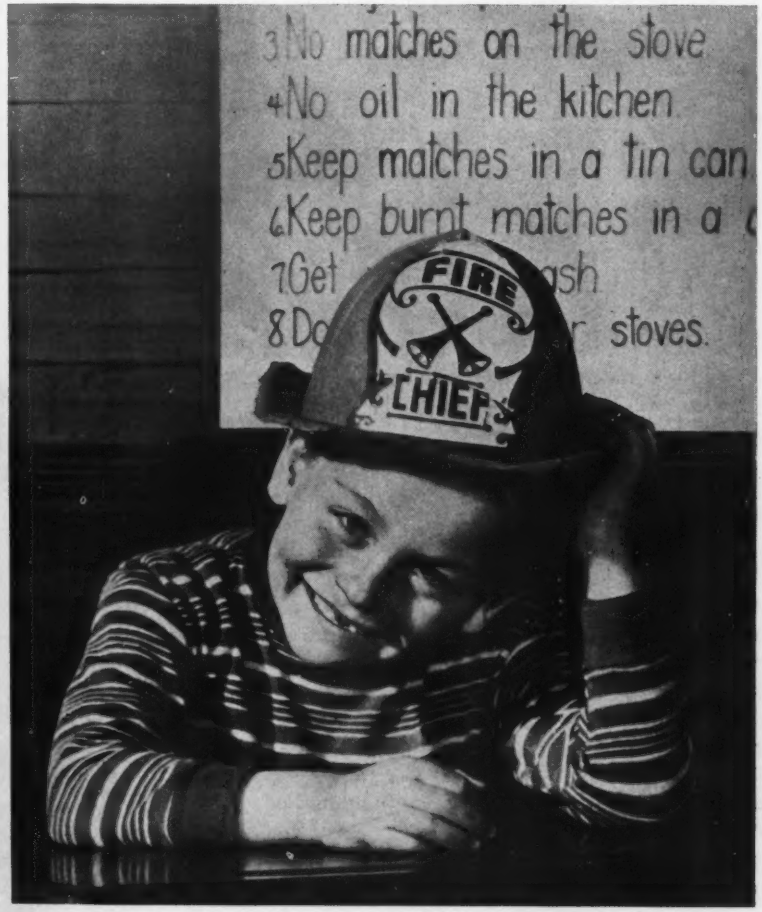
Schools in Atlanta, Baltimore, Cleveland, De Kalb (Illinois), Hagerstown, Jacksonville (Illinois), Kansas City (Missouri), Philadelphia, Pittsburgh, Prince George County (Maryland), Tulsa and Washington, D. C., cooperated in the experimental classroom fire safety program launched nationwide by the National Education Association in 1950.

Their Fire Safety Series No. 2 is keyed to "middle graders" of our intermediate schools. In this pamphlet the teacher is urged to approach the subject by giving the students opportunity for fire safety "Experience, Experiment and Expression." Firsthand "Experience" by participation in fire drills, helping in clean-up campaigns, putting out picnic fires, are living learnings that build fire safety conscience and habits. "Experiment," the middle name of the middle-grade boy, can be used to learn the safe and unsafe ways to handle fire in supervised trials to discover what is flammable or combustible and how fires can be extinguished. Children learn through "Expression" in the arts — the language arts of reporting, conversing, discussion, writing, drawing and recording. The NEA suggests limitless ways to turn these three "E's" to the profit of fire safety education.

How Junior High School children become agents for fire safety through "Action, Adventure and Awareness" is clearly exhibited in the NEA's pamphlet, Fire Safety Series, No. 3. Teenagers are willing to do something about the problem of fire prevention — they are old enough to use fire "know-how" intelligently and

yet young enough to attack the problem with intensity and energy. To provide concrete aids to the teacher this NEA pamphlet illustrates how fire safety education can be included in junior high social studies, in courses on citizenship, in languages, science, mathematics, home economics, art and shop. This 32-page pamphlet also gives hints on how to attract attention to fire safety, how to keep interest alive, how to capitalize on community resources, plus methods of translating the lessons into practical application in the home, school and community.

All of these NEA pamphlets have been developed with the blessings, urgings and help of the National Fire Protection Association. The National Commission on Safety Education and the National Council for the Social Studies of the NEA have been basically responsible for the issuance of the material. Each of the pamphlets costs fifty cents apiece and discounts are given for multiple copies. Orders and checks should be made to the National Education Association, 1201 Sixteenth Street, N. W., Washington 6, D. C.



This photograph appears on the cover of the NEA's manual on "Fire Safety for Teachers of Primary Grades."

Fire Safety For Drive-In Theatres

The growth of the drive-in theatre industry since the first theatre of this type was constructed in Camden, N. J., in 1933 has been important to the amusement business, particularly since World War II. In June 1949 more than 1,000 drive-in theatres were in operation in 45 states, with a gross annual (though usually seasonal) business estimated to be $51,000,000.* The current estimate is approximately 2,000 drive-in theatres, with a capacity of 600,000 automobiles. This is an important segment of the amusement industry and prudent management will adopt fire prevention and protection methods successfully used in other occupancies to continue in business without interruption.

Due to the inherent need for large area space for parking automobiles (500-1,500 car capacity) the drive-in theatre is almost certain to be located in rural areas without public fire protection facilities or on the outskirts of municipalities remote from public fire protection. This factor may be compensated for by planning for emergencies and the provision of fire-safe construction.

Construction

Municipal and state ordinances or regulations thus far enacted are principally concerned with traffic conditions for drive-in theatres, although appropriate refer-

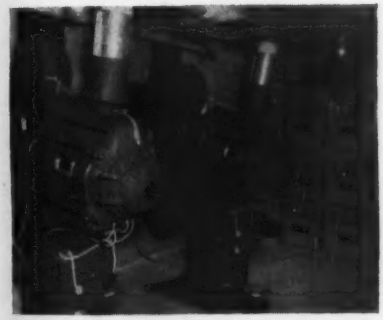
*Policy on Drive-In Theatres, The American Ass'n. of Highway Officials—1949. Price $1.50.

ences to the protection of fire hazards are also included. Plans and specifications are usually required to be submitted to enforcing authorities to enable them to determine the adequacy of fire protection measures as well as other important health and public safety features of design and construction.

While there is great variation in costs of materials, grading, drainage, etc., due to the variables at the site, an estimate of the minimum investment in structures and equipment for a 500-car capacity drive-in theatre is approximately $50,000 — approximately 55 per cent of the total investment required.

Projection Building

The requirements of the N.F.P.A. Standards for the Storage and Handling of Nitrocellulose Motion Picture Film should be followed in detail in the construction and equipment of projection buildings. The record of fires in projection booths in indoor theatres has improved since the advent of modern projection equipment with built-in fire traps, fire rollers and enclosed magazines. This improvement should not, however, be used to justify the use of combustible material in a projection building, especially in view of the distance to public fire service of the usual drive-in theatre. Fire-resistive (reinforced concrete, protected steel framed) construction should be used throughout projection buildings.



All electrical equipment should be installed in accordance with the requirements of the National Electrical Code, and the same separation provided for generator or rectifier rooms from the projection room.

Projection rooms for drive-in theatres are not subject to the same space limitations as in indoor theatres and can be more spaciously arranged. Entrance to projection rooms should be through a vestibule from the outside and the public prohibited from access to it.

Screen Tower

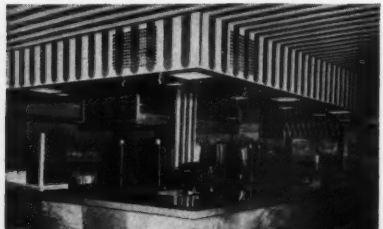
It is highly desirable that screen towers (34 x 45 ft. or more) be constructed of noncombustible material. In 1949 a fire occurred in a combustible 70-foot high screen near a floodlight installation. The screen burned down due to high winds and an inadequate water supply. There was no panic or other confusion, but the theatre was out of business until the screen tower could be rebuilt.

Protection against lightning is an important factor in safeguarding screen towers, and lightning protection should be provided as recommended by the N.F.P.A. Standard No. 78.

Screen towers should not be used for miscellaneous combustible storage unless the storage areas are safeguarded by walls, partitions, and ceilings of fire-resistive materials so constructed that a burn-out of the room could occur without damage to the screen tower.

Concession Stands

Concession stands are often included in the projection building and the same recommendations concerning the use of fire-resistive construction are valid.



A separate building for the concession stand is desirable for the reason that recent developments include many ancillary services, such as restaurants, bars, dance halls, self-service laundries, sandwich, pop corn and soft drink stands and other occupancies. The hazards in such occupancies should be safeguarded in accordance with general good practice regarding installation of electrical wiring, cooking and heating equipment, etc., applied to such occupancies in conventional buildings. Gasoline filling stations operated in conjunction with drive-in theatres should also meet standard requirements.

Automobile Fires

The danger of automobile fires is not as great as that in an ordinary congested parking lot. In drive-in theatres ramps for cars must be sufficiently spaced (38 ft. minimum — 40 ft. preferred) to permit clear vision of the screen tower, and to permit driving in or out without disturbing others in the audience. In addition, automobiles are usually occupied and thus if one car catches fire, adjoining cars can be readily driven out of the way, and there will be drivers to do so.

Fire Protection

As indicated above, drive-in theatres are usually remote from public fire services. Thus, dependence must be placed on the adequacy of first aid fire equipment and adequately trained theatre personnel to handle fire emergencies. Fire extinguishers of the proper type for the hazards and distributed in the conventional manner are required.

In existing drive-in theatres, wholly or partly of combustible construction, it may be possible to provide water supplies from storage tanks, ponds or streams sufficient to supply hose streams manned by the theatre fire brigade.

The N.F.P.A. Standard No. 27, Private Fire Brigades, Organization, Drilling and Equipment, will be found useful in the training of the theatre fire brigade.

In general, drive-in theatres provide a safe place for amusement for car owners and their guests. Many do not wish to dress up, are unable to find "baby sitters," or wish to entertain the physically handicapped or infirm who find it awkward or impossible to attend an indoor theatre. An adequate fire prevention and protection program practiced by the management of drive-in theatres will maintain their properties in continued operation.

Illustrations courtesy Joe Cifre, Inc. (NFPA member), Boston, Mass., and Motiograph, Inc.

Fertilizer-Grade Ammonium Nitrate

Condensed from Manual A-10 issued by the Manufacturing Chemists' Association, Inc. For full details, reader should secure copies of the Manual from the Association at 246 Woodward Bldg., Washington 5, D. C. (50 cents per copy.)

Fertilizer-grade ammonium nitrate contains 33 per cent of its weight as available nitrogen and is now one of the most important nitrogen plant foods.

The bulk of the ammonium nitrate made in North America is manufactured from ammonia produced in privately-owned plants, some of which were built by the Federal Government to supply military chemicals essential for the war period. Ammonia is chemically combined with nitric acid, also made from ammonia, to form the compound ammonium nitrate. The production from the converted government plants, both in the United States and Canada, has made possible greatly enlarged supplies for domestic use. The present fertilizer-grade ammonium nitrate consists of little pellets or balls of specially prepared ammonium nitrate of high purity, covered by a small amount of inert conditioning material.

One of the major problems connected with the distribution and use of fertilizer-grade ammonium nitrate has been the apprehension which resulted from the disastrous ship explosions at Texas City, Texas in 1947, in which a form of fertilizer-grade ammonium nitrate was involved.*

Ammonium nitrate is classed chemically as an oxidizing material. This means that the oxygen which it contains can support combustion if it is involved in a fire with combustible materials. Like other chemicals of this type, the material must be so stored and handled that it does not become mixed with other products which will burn. With simple precautions, fertilizer-grade ammonium nitrate can be stored safely at the factory, in distributors' warehouses, or on the farm. As in the case of gasoline which can form explosive mixtures with air; or insecticides which may be toxic, ammonium nitrate deserves common-sense treatment during transportation, storage and use.

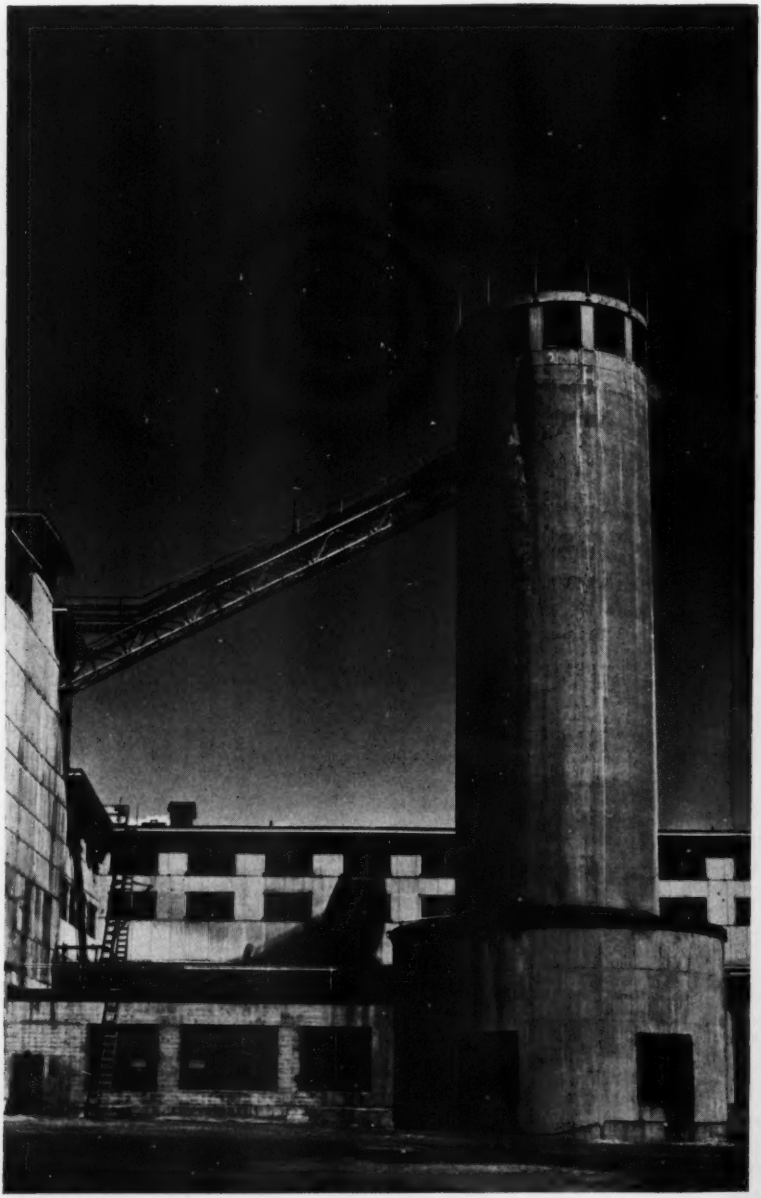
*See NFPA *Quarterly*, July 1947 and October 1947.

Packaging Techniques

Fertilizer-grade ammonium nitrate is packaged at the points of production in moisture-resistant multi-wall paper bags. These usually contain 100 pounds of material, but some of 80 pounds net weight are now used.

The multi-wall paper bag is fabricated of four to six plies of strong Kraft paper, in tubular form and so nested, one within the other, that each carries its proportionate share of the burden. The paper is designed to meet certain minimum specifications as to strength. In effect, the bag is a series of paper bags, one inside the other, the whole being closed by proper water-resistant glue and by tape or stitching.

A moisture barrier must be of such material and so applied on the paper layers that it is a continuous barrier against passage of water, which may get into the bag, or moisture from the air. Should either rain or atmospheric humidity get into the contents, the material may cake sufficiently to be difficult to use on the farm. The moisture barriers commonly used are



Courtesy MCA

Ammonium Nitrate Prilling Tower. Present day fertilizer-grade ammonium nitrate consists of little pellets or balls of specially prepared ammonium nitrate of high purity, covered by a small amount of conditioning material.

either asphalt layers between paper plies, or a plastic coating inside the innermost bag.

Labeling of Bags

The face of a typical bag of ammonium nitrate fertilizer is printed with information as to the name and nature of the contents, the brand and manufacturer, and a statement as to nitrogen content to meet the regulations imposed by most states. This guaranteed analysis indicates total available nitrogen, usually expressed as a summation of the nitrogen content which is in the ammonia form and that which is in the nitrate form.

Bags usually carry two informative or cautionary labels. One of these is the standard yellow "Caution" label prescribed by the Interstate Commerce Commission. The other is a cautionary label recommended by the Manufacturing Chemists' Association, which advises to: (1). Keep away from heat and open flame; (2). Do not store with combustible materials; (3). In case of fire, flood with water; (4). Burn empty bags promptly in the open; (5). Place broken or torn bags and contents in overslip bags; (6). Sweep up and dispose of all spilled material immediately; (7). Do not rebag loose material.

Courtesy MCA

Using "overslip" bag to protect contents of damaged containers of fertilizer.

Effect of Heat

When ammonium nitrate is heated 70 to 80 degrees above its melting point (337°F.), it begins to decompose into nitrous oxide (laughing gas) and steam. It gives up a small amount of heat. The decomposition starts very slowly at about this temperature (410°F. to 420°F.), but becomes increasingly vigorous as the temperature is raised. The decomposition is a well-behaved chemical process at temperatures up to about 500°F., at which point it becomes too rapid for easy control.

At temperatures between 500° and 550°F., the decomposition products begin to include free nitrogen and oxygen, and the amount of heat given up increases about fourfold. Since any chemical process which produces gas and an appreciable amount of heat is potentially explosive, *there are conditions under which the high*

temperature decomposition of ammonium nitrate will proceed at an explosive rate or may produce explosive effects.

If a dynamite charge or other explosive primer is detonated in ammonium nitrate or in mixtures containing large proportions of ammonium nitrate, an explosive rate of decomposition may result. In this case, the localized rate of heating of the ammonium nitrate by the primer or explosive is extremely rapid.

Under certain conditions, an explosive rate of decomposition may be established very quickly by such use of dynamite. Thus at Oppau, Germany, in 1923, blasting with dynamite started an explosive decomposition of approximately 450 tons of a pile containing about 4500 tons of a mixture of ammonium nitrate and ammonium sulfate. This mixture was obviously very difficult to decompose, for, according to the records of the corporation involved, the pile had been dynamited thousands of times before the single explosion occurred. Other such decompositions of materials containing large proportions of ammonium nitrate have been reported as having been caused by explosives. Therefore, under no circumstances should fertilizer-grade ammonium nitrate be exposed to the action of explosives.

When ammonium nitrate is heated to a high temperature in a bomb or other closed container which retains the products of decomposition and the heat of reaction, the temperature and pressure may suddenly rise dangerously high and may result in an explosion. *Fertilizer-grade ammonium nitrate should, therefore, not be heated when confined.* In this respect, ammonium nitrate is similar to many other materials, such as water, which develop high pressures when heated under confinement.

There have been a large number of fires involving granular ammonium nitrate and materials containing it, including various fertilizer types of ammonium nitrate. No explosions of fertilizer-grade ammonium nitrate have resulted from fires under any condition with the sole exception of three Liberty ships, which burned and then exploded during 1947. Two of these ships, the S.S. *Grandcamp* and S.S. *High Flyer*, burned and exploded to cause the tragic Texas City disaster of April 16 and 17. The third vessel, the S.S. *Ocean Liberty*, burned and then exploded off Brest, France, in July of the same year.*

It should be recognized that a number of conditions which would be expected to contribute to the development of an explosive rate of burning evidently existed on each ship. The particular variety of wax-coated fertilizer-grade ammonium nitrate contained one per cent of combustible, and so developed appreciably more heat and gas than the inert-coated type now usually sold. Furthermore, the material was stowed solidly into the holds so that at various stages of its progress, the original fires could have burned under conditions of confinement that would lead to an explosive rate of burning and decomposition. The holds of the vessels were, in effect, fire-resistant boxes with restricted outlets for the gases *and heat*. In each shipboard explosion, the lack of effective fire-fighting measures permitted the fires to grow to uncontrollable proportions.

Transportation Regulations

There are three sets of official regulations which apply to the transportation of fertilizer-grade ammonium nitrate, dealing respectively with movements by rail, highway and water.

*See NFPA *Quarterly*, October 1947.

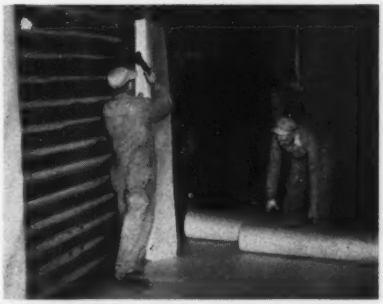
1. *Rail.* Fertilizer-grade ammonium is classed as an oxidizing material under Interstate Commerce Commission Regulations for the rail transportation of explosives and other dangerous articles. As such it is one of a general group which includes such other chemicals as sodium nitrate, potassium nitrate and calcium nitrate. The general provisions of these rules authorize its shipment in tight, moisture-resistant bags of 200 pounds or less capacity, if the containers meet certain stated requirements. In all but a few cases of industrial movement, the individual bags bear the yellow I.C.C. Caution Label and the rail cars which hold them bear the I.C.C. "Dangerous" placard. Other containers and certain bulk shipments by producers are permitted, but are not customary for fertilizer-grade ammonium nitrate. Shipments made by rail express are limited to a maximum of one hundred pounds in any single outside shipping container.

2. *Highway.* There are comparable I.C.C. regulations governing truck transportation which authorize the same containers and include provisions as to caution labels and placards. A few types of bulk shipment are permitted. Certain stipulations are made as to types of vehicles. In general, packages authorized for rail are acceptable for highway movement.

3. *Water.* The United States Coast Guard has adopted regulations applying to the transportation of this material by water. The Coast Guard regulations also include certain limitations as to locations for transfer to shipboard. The same containers used for land transportation are authorized for shipboard use. Although water transport does not require complete labeling, practically all packages so moved are fully labeled because they reach shipside by rail or highway.

Rail Transportation Experience

Several million tons of fertilizer-grade ammonium nitrate have been transported on this continent by rail in recent years. As reasonably could be expected in the movement of this tremendous tonnage, a few of these shipments were involved in mishaps such as derailments, collisions and fires. *In not a single instance did any of these accidents result in an explosion.*



Courtesy MCA

Lining of freight car after car has been thoroughly swept clean and all protruding nails removed.

A brief review of some of these typical fires is outlined below:

1. A wooden boxcar fully loaded with about 1,200 bags of fertilizer-grade ammonium nitrate was struck by a steel hopper car during a switching operation in a railroad yard. Both cars were derailed and so badly damaged and tangled that unloading was impractical and it was necessary to cut some of the gear with an acetylene torch to make possible the removal of the cars with a wrecking crane. The boxcar and contents became ignited during this operation and the repair crew attempted unsuccessfully to extinguish the fire with a soda-acid fire extinguisher while awaiting arrival of the local fire department. The fire spread rapidly and the car was completely enveloped when the

local fire department arrived and applied a hose stream. The fire had made such headway that extinguishing efforts were unavailing and the entire lading was destroyed and the car structure badly damaged.

2. Smoke was observed issuing from a boxcar partially loaded with bags of nitrate, which was standing with doors open in the loading yards after workmen had stopped loading for a rest period. This fire burned slowly for some time without becoming intense and was finally extinguished by application of water from a deluge pump.

Courtesy MCA

Recommended loading pattern for freight cars and proper handling of bags.

3. A "hot box" was observed enroute on a boxcar containing about 1,100 bags of fertilizer-grade ammonium nitrate and the car was set out of the train on a siding. Shortly afterward, it was observed that the fire had been communicated to the wooden structure and had contacted the lading before the local fire department arrived. Water was applied and the fire extinguished when about half the lading had been destroyed and considerable damage done to the car structure. Approximately one-half the lading was salvaged in usable condition.

4. A train carrying several cars loaded with fertilizer-grade ammonium nitrate was standing in a yard when a brush fire developed adjacent to the tracks. As wind was blowing vigorously from the fire toward the loaded cars, they were moved to another location. When smoke was observed issuing from one of the cars, it was isolated and the local fire department called. The fire developed such intensity that extinguishing efforts failed and the lading was completely destroyed.

5. A carload of bagged fertilizer-grade ammonium nitrate was moving in a train made up of miscellaneous freight which included a number of cars of gasoline. Several of the cars were involved in a serious derailment that caused rupture of some of the gasoline cars. The gasoline became ignited in a fire that was visible for several miles. The car of nitrate also became ignited and burned completely with entire loss of the lading and car. It was not practical to attempt extinguishment.

These are brief accounts of typical transportation accidents which resulted in fires. In some of these cases the lading was subjected to severe and unusual mechanical shock. Detailed investigation of these and other fires, and subsequent laboratory examination, have failed to indicate that any of these fires was caused by spontaneous heating of the nitrate. The incidents outlined are representative of the experience in rail transportation accidents in which nitrate was involved.

Proper Ship Stowage

The following instructions for the stowage of fertilizer-grade ammonium nitrate on shipboard and for safe fire-fighting methods have been developed from experience and are now recognized as a guide to good practice:

1. On entering a port, any ship having ammonium nitrate aboard, or expecting to load this material, usually must notify the Port Authorities. The Authority in turn will notify the local fire department and otherwise arrange for handling the vessel. The ship is berthed to permit getting underway quickly in case of fire. Tow lines for tugs are usually suspended fore and aft, so as to be available conveniently not more than four feet from surface water.

2. In preparing the ship for loading, all holds must be thoroughly cleaned before loading operations are begun. If the ship has previously carried combustible materials, the hold and other contaminated areas must be thoroughly swept and washed.

3. Only ventilated stowage of fertilizer-grade ammonium nitrate should be permitted. Solid "block" stowage of this material is not desirable. Before actual loading begins, those in charge should prepare a definite plan for piling which will provide adequately for needed ventilating spaces throughout the cargo. Ventilation ducts, from 5 to 15 inches wide, practically continuous from bottom to top, should be arranged for and spaced 8 to 12 feet apart, running lengthwise of the ship. These ducts also provide for flooding quickly with water in the event of fire. The spacing and arrangement of these ventilation ducts must be worked out in a way suitable for the individual hold being stowed.

4. Fertilizer-grade ammonium nitrate should not be stowed in holds immediately adjoining the boiler room bulkhead. The material must be kept clear of steam lines, electric wiring, and any other potential sources of heat.

5. After the hold has been thoroughly cleaned, dunnage boards should be secured along the sides to provide a uniform flat surface against which the bags may be piled. All special openings, such as floor drains, must be thoroughly covered or closed so that loose material cannot enter them.

6. If fertilizer-grade ammonium nitrate is to be carried on a ship which also carries other cargo, a suitable arrangement of different parts of the cargo is essential. Combustible material, finely divided metal, chlorates, permanganates and the like, strong acids, or other reactive chemicals should never be stored immediately adjacent to the ammonium nitrate. It is especially important that such reactive materials should not be stored either above or below the nitrate, since accidental breakage of containers might permit mixing, with consequent danger of fire as well as contamination and possible destruction of the cargo. All such materials properly stowed and kept separate are safe, but the mixtures may cause serious difficulty.

7. Smoking and use of open lights during loading or while hatches are still open must be strictly prohibited at all times.

8. Careful handling to avoid tearing or bursting of bags is necessary, both to preserve the cargo and to prevent danger from spilled material. Should any of the ammonium nitrate be spilled during loading or handling, this spilled material should be swept up promptly and disposed of. Broken bags which have not been spilled may be placed safely in overslip bags which are customarily provided. Loose material should not remain aboard ship, but can be disposed of safely by dumping overboard.

9. When stowage has been completed, the hatches covering the appropriate holds

should be closed securely and then covered with tarpaulins adequately secured. If loading is interrupted, such closures should be provided until loading is resumed, except in the case of very brief periods.

10. In the event fire should break out in a hold containing ammonium nitrate the hatches should be opened immediately and a generous supply of water (either fresh water or sea water) used as an extinguishing agent. *Steam should never be used for fire fighting in compartments or holds containing ammonium nitrate.* If lines for steam smothering are connected to the holds in which this material is stowed, they should be disconnected, locked, or blanked off in order to prevent improper use.

Storage Experience

A number of fires involving stored fertilizer-grade ammonium nitrate have been reported. In only one case did such fire originate in or near the fertilizer material itself. In most cases the fires occurred in rural areas—barns or farm storage buildings—remote from adequate water supply for fire fighting purposes. As a consequence, the buildings were generally badly damaged or destroyed. In some instances, a portion of the stored fertilizer material was not destroyed despite the fire around it.

Among the most significant fires reported was one in a large warehouse where more than a thousand tons of fertilizer-grade ammonium nitrate was stored. A detailed study of this fire* reveals that the fire originated in an adjacent building which contained alfalfa meal. The fire spread to the warehouse containing the nitrate. Although the building was a complete loss, approximately ten per cent of the fertilizer was saved by effective fire fighting methods.

The single instance in which fire originated in fertilizer material containing ammonium nitrate occurred in a mixture of this fertilizer with organic materials and uncured superphosphate. The bulk storage of this mixed material resulted in internal heating of the pile, which was followed by fire. Manufacturers caution against such mixing, both for safety and to avoid waste. Such mixtures are almost certain to lose some of the valuable plant food constituents which have been added in the components, because of reaction between the materials mixed.

Investigation of all commercial and farm storage fires does not reveal a single case in which an explosion of ammonium nitrate occurred.

Proper Warehouse Storage

As in the case of many other commodi-

Courtesy MCA

Recommended method of piling fertilizer. Note access space between piles.

*Details published by the NFPA in Aviation Bulletin, Series 1949, No. 30 dated December 28, 1949. (25c per copy.)

ties, fertilizer-grade ammonium nitrate should be stored on a clean floor and in a well-ventilated structure. It should be readily accessible, and stored away from electric wiring, steam pipes, radiators, explosives, organic materials, acids and easily oxidized materials.

The precautions and recommendations listed on the bag labels should be particularly observed. Smoking must not be permitted in a warehouse or in the area surrounding it. As a matter of economy, it is important that the material be protected from container breakage, spillage, and access to moist air.

The following storage recommendations, adapted from the proceedings of the conference on Ammonium Nitrate Fertilizer of the National Research Council of Canada, are considered to be good practice:

1. Bags of ammonium nitrate fertilizer should be stored not less than thirty inches from the storage building walls in piles not more than twelve feet in width, with thirty-inch aisleways between piles. Bags should not be stored closer than thirty-six inches from the eaves of the roof or supporting and spreader beams overhead.

2. Roofs and floors above masonry or concrete walls should be of light weight construction and should not be of concrete or masonry. Wooden structures are authorized.

3. Ammonium nitrate fertilizer should not be stored in any structure in which any explosives are kept.

4. Warehouses or structures used for storage purposes should be clean, and be maintained in good housekeeping order.

5. Ammonium nitrate fertilizer should not be stored over or under any organic chemicals, flammable liquids, corrosive acids, chlorates, permanganates and the like, finely divided metals, sulfur or combustible material other than dunnage. Storage piles should be at least thirty feet away from these materials.

6. The material should not be stored closer than three feet from steam or hot water pipes, radiators, heating devices, or electric wiring, fittings or switches.

7. Ammonium nitrate fertilizer may be stored on clean concrete floors or wooden pallets or dunnage on any type of clean floor. Floor drains into which molten nitrate can run during a fire should be eliminated or plugged.

8. Spilled material should be cleaned up promptly and disposed of. A broken or cracked bag containing uncontaminated fertilizer may be salvaged by placing it inside a clean new over-slip bag and closing securely.

9. Except at fertilizer manufacturing plants, ammonium nitrate fertilizer should be stored only in containers.

10. Smoking should not be permitted in or near storage spaces.

11. Open lights or flames should be prohibited in or near storage spaces.

12. Fire hydrants, exterior of the storage spaces and conveniently placed, with adequate hose available and capable of extension to all parts of the storage, should be provided.

Fire hydrants with adequate water pressure and suitable fire hose should be ready for prompt use at all times. Thus, a minor fire can be controlled quickly and any serious danger prevented. The rules applicable for general fire fighting can be used on shipboard as well as on land. Means for adapting them to shipboard use should be obvious to any experienced master or fire department official.

What Is A Hazardous Occupancy?

By Robert S. Moulton,
Technical Secretary, NFPA

The question as to what does and what does not constitute a hazardous occupancy is a constant source of confusion in various fire protection applications involving the type of electrical installations, the class of automatic sprinkler protection, the type of building construction and other features. The difficulty in securing agreement on what is a hazardous occupancy or location arises from the difference in points of view of different interests concerned, and a lack of clear understanding of the problems. In a recent meeting of the NFPA Committee on Automatic Sprinklers, during a discussion of the occupancy classification for light hazard, ordinary, and extra hazard types of automatic sprinkler protection, one of the committee members facetiously defined an extra hazard occupancy as any one where the insurance companies might have to pay a large loss. This, however, actually has little or no bearing on the hazard of occupancy, as the size of the loss that may be incurred in a fire is contingent not on the hazard but on the total values exposed to destruction by a fire.

In considering the hazard of occupancy, the first point to establish is that by hazard of occupancy we mean occupancy and not construction. Actually the loss potential depends upon both structure and contents, but in occupancy hazard we are concerned only with contents or with the type of activities usually associated with a given class of occupancy. There are a good many classes of occupancy where the fire record is not good because of the kind of building in which the occupancy is housed, and the type of fire protection available, rather than due to any unusual hazard of contents or activities. For example, the fire loss experience in resort hotels is largely due to the extensive use of wood construction, lack of fire walls, unprotected vertical openings, and inadequate alarm and extinguishing facilities, rather than to the hotel occupancy per se. Hotels are classified as a light hazard occupancy by the NFPA Standards on Automatic Sprinklers, but this classification pertains to the contents hazard, and not to the structure or to the life hazard. There are many classes of occupancy which have an unfavorable fire record due primarily to the kinds of buildings used and the lack of protection, rather than to the inherent combustibility of the contents. The answer in such classes is not to condemn the entire occupancy class, but to correct structural and fire protection deficiencies, and then to consider the contents hazard on its own separate merits.

The extra hazard occupancy is likewise one to be determined on the basis of the amount of the combustible contents, their rate of burning, and the presence of hazardous processes, all considered independently of the combustibility of the structure housing the occupancy. In cases of high hazard occupancy, it is generally agreed that the building must be fire-resistive, and building codes so provide in most cases, on the theory that hazardous occupancy plus combustible structure would endanger the public safety to an un-

reasonable degree. This reasoning is sound to the extent that fire-resistive construction restricts the spread of fire, and localizes the contents hazard, but unsound where it requires massive construction in situations where there is an explosion hazard and light, explosion-venting construction is actually indicated. Furthermore, there are some occupancies so hazardous that the only practical safeguard is segregation into very small individual units spaced far enough apart so that a fire or explosion in one unit will not propagate to others, as is common practice in certain explosive operations. In such cases the type of construction is a relatively unimportant factor.

The determination of rating of building structure or fire-resistive safes or vaults should be determined on the basis of the total concentration of combustibles, including both contents and structure. The NFPA Committee on Protection of Records, on the basis of fire test data, specifies the type of vault to be provided, based on the weight of combustible material per square foot in the building. This, however, may be quite independent of hazard of occupancy as ordinarily conceived. For the purpose of resistance of structural elements, the time factor is most important — a long continued fire of relatively low intensity may do more structural damage than a much hotter fire of short duration, but the long continued slow fire is not generally considered as representing a high hazard occupancy as it does not overtax ordinary fire extinguishing facilities if properly utilized.

Hazardous occupancy to the electrical inspector is something quite different; it is the presence of an atmosphere, actual or potential, likely to result in a flash fire or explosion when an ignition source is provided by an electric spark or heated electrical element. The National Electrical Code defines this in detail, specifying three different classes of hazardous location, and subdividing these classes according to the relative degree of hazard. What may be a hazardous occupancy for the purposes of the National Electrical Code is not necessarily a hazardous occupancy for the purpose of application of the Sprinkler Standards.

For consideration of life safety from fire, still different factors must be considered. The NFPA Building Exits Code establishes three classes of occupancy depending on the degree of danger to life, and specifies emergency exits accordingly. In many respects the classification here is the same as for other purposes, but the presence of contents likely to produce toxic smoke or gases in case of fire establishes the occupancy as high hazard, even though for other purposes the occupancy might not be so classified.

The major difficulty with occupancy classification is that the nominal occupancy is not necessarily indicative of the hazard. A salt works, nominally low hazard, has a serious fire in a storage of wooden barrels. A dry cleaning plant, nominally high-hazard, uses a non-flammable solvent. Similar examples might be quoted almost endlessly. Occupancy hazard classifications are convenient, and may often be necessary for administrative purposes, but they can never be completely indicative of the actual hazard, and can never be a satisfactory substitute for an intelligent engineering appraisal of the hazard of the individual property.

Michigan State Office Building Fire

By James K. McElroy,
Assistant Technical Secretary, NFPA

An estimated 1,000 to 1,500 tons of records, highway department plans, and other combustible materials stored under sub-standard conditions in the "mezzanine" story between the sixth and seventh stories of the State Office Building, Lansing, Michigan, were destroyed in a fire set by an employee of the State Highway Department during the noon lunch hour, February 8, 1951. The last engine company was returned to quarters on February 12. Sixteen firemen, including Chief Hugh Fisher, were hospitalized for injuries and smoke inhalation during the first 24 hours due to the heat and smoke which collected in the unusual "mezzanine" story. The height above the ground and the inadequate access to the upper stories of the building handicapped fire fighters.

The fire is believed to be the largest record loss since the Burlington Office fire, Chicago, Illinois, March 15, 1922.* This fire differs from most large loss fires in that the conditions which existed at the time of the fire had been known to exist for many years, and both state and local authorities had made repeated recommendations for the correction of hazards which, if followed, would have prevented or, at the least, minimized the loss.

The Building

A better understanding of the conditions facing the Lansing Fire Department when they arrived on the scene may be obtained from a description of the building and the amount and disposition of the con-

*See July 1922 *Quarterly*.

Acme

This picture of the east elevation of Michigan State Office Building was taken the morning following the fire of February 8, 1951. The mezzanine story (without windows), where the fire originated, is just below the top story.

tents in the "mezzanine" story.

The building was built at a cost of $3,000,000 and occupied in 1923. It is a U-shaped, seven-story, full basement and "mezzanine," fire-resistive structure with 31,600 sq. ft. gross floor area per story.* The "mezzanine" floor, between the sixth and seventh stories, was approximately 95 feet above grade (its net story height 8 feet), and the seventh story ceiling approximately 116 feet above grade. The exterior curtain walls are masonry faced with stone, with large steel casement sash and 5/16-inch plain plate glass windows, except that in the "mezzanine" story small windows were installed in the court walls only.

It is estimated that the building was designed to support a live load of approximately 75 pounds per square foot. It is a reinforced concrete framed structure. Floors and roof are 2 inches of reinforced concrete on 5-inch reinforced concrete joists with hollow tile fillers between. Except in the basement and the "mezzanine" story, floor assemblies were protected by suspended metal lath and plaster ceilings without acoustical treatment. The estimated fire resistance rating of the seventh floor assembly under the Standard Test for Building Construction and Materials (NFPA No. 251) is approximately 3 hours, based on available test data on other assemblies.

The partitions throughout the building, except in the "mezzanine" story, are conventional gypsum tile plastered on both sides. Doors throughout were wood, glass paneled in the corridors. The "mezzanine" story had heavy diamond mesh wire screen enclosures for the several departments, each gate being locked individually.

*See *Fires in "Fireproof" Buildings* for reports of 32 other serious fires and explosions in fire-resistive buildings (July, 1950, *Quarterly*), also available in separate pamphlet form.

Michigan State Police

Court area of the State Office Building, Lansing, Michigan, in the early stages of a fire, set by an arsonist, on February 8, 1951. Note small windows in mezzanine story were just above the reach of a 100-ft. aerial ladder.

A single unenclosed stairway, located adjacent to the enclosed passenger and freight elevators, served approximately 32,000 square feet floor area in each story. (See floor plan, page 292.) Recommendations made for the enclosure of this stairway and for additional enclosed stairways or fire escape stairs at the extremities of the north and south wings, had been repeated over many years.

Access from the seventh story to the "mezzanine" in the north wing was through a stairs, enclosed at the top with a wood panel door and by an unenclosed stairway in the south wing. An enclosed dumb waiter elevator shaft extended from the sixth story through the "mezzanine" and the seventh story in the north wing.

The building was heated by steam from an outside source, fed from the mains in the "mezzanine" story up and down to direct radiation. Fresh air intakes were located in the "mezzanine" story, utilizing 11 of the small window areas in the court

International News

Smoke belching from the small court windows of the mezzanine story in the area where fire originated in the State Office Building, Lansing, Michigan, February 8, 1951.

wall. Fan rooms for exhaust ventilation were located on the roof, and metal ducts throughout were furred with metal lath and plaster except in the "mezzanine" story. Wiring was in conduit.

Occupancy

The building was used for conventional office purposes, drafting rooms, occasional laboratory space, the State Library (first story) and storage space for all departments using the building in the "mezzanine" story.

In effect, the "mezzanine" story had been a single fire area "vault" of approximately 250,000 cubic feet and 3 hours fire-resistance rating, loaded with combustible material from the floor to the ceiling since 1923. Records, supplies, and other materials were stored in open wood bins or shelving, ordinary wood and metal filing cabinets, paper cartons, etc. Each department had independent control of its own wire mesh enclosure. A few areas were used for employee working space, including the highway department space in which the fire was started.

Recommendations had been made in 1937, 1940, 1944, 1946 and 1949 for the sub-division of the "mezzanine" story by fire-resistant partitions and the installation of automatic sprinklers. It is estimated that an expenditure of less than $30,000 would have been required to subdivide properly and to protect the "mezzanine" story with sprinklers. Had these important corrective measures been taken the loss should have been limited to the area in which the fire started. Heavy loss in the "mezzanine" story could have occurred, in the writer's knowledge, at any time since the building was opened for use in 1923.

Origin of the Fire

Richard C. Shay, 19-year-old father, an employee of the highway department, confessed on February 10 that he set the fire in the microfilm room on the "mezzanine" in a misguided attempt to evade the military draft from which (as a father) he was already exempt. Ironically, he will certainly "escape the draft" for from four to ten

Pat Mitchell

State Highway Department plan storage in the mezzanine story of the State Office Building, Lansing, Michigan, prior to the fire on February 8, 1951.

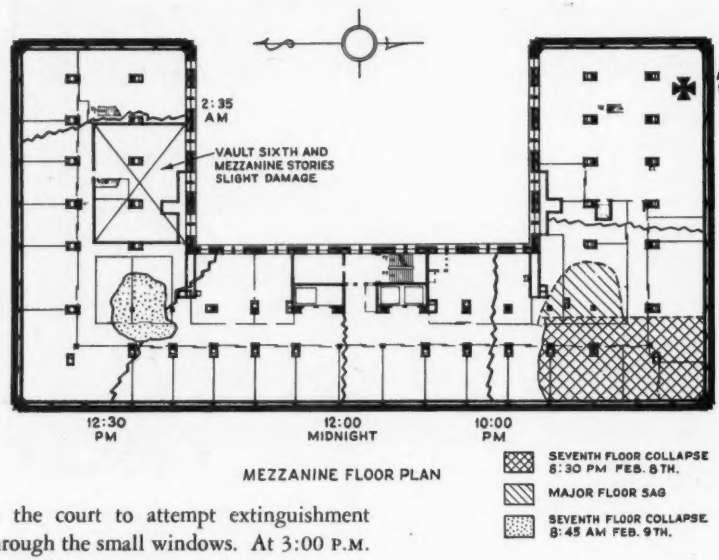
years; sentenced on March 15.

Only a few of the 1,300 employees were in the building, none in the "mezzanine" story, when Shay ignited some loose plans at an undetermined time prior to 12:40 P.M. There is evidence to support the statement by Shay that he tried unsuccessfully to fight the fire with a hose line from a near-by standpipe before the fire was reported to the fire department. The fire was reported by an office girl and a telephone operater by box alarm and telephone at 12:40 P.M.

Progress of the Fire

The fire was well under way upon the arrival of nine pieces of apparatus, including a 65- and a 100-foot aerial ladder, in response to the first alarm. At 12:54 P.M. a third alarm brought additional pumpers and personnel to the scene. At 1:06 P.M. an emergency alarm brought all available apparatus and personnel, and set in motion a mutual aid plan for filling in at stations vacated.

Under adverse weather conditions (wind velocity, 24 mph; temperature, 7° above to 9° below zero F.) simultaneous attempts were made to reach the seat of the fire, one from the seventh story to the "mezzanine" floor, via the enclosed stairway in the north wing, and another from the central stairway at the "mezzanine" floor level. Both failed, even though firemen were equipped with oxygen masks, due to the rapid build-up of heat in the low-ceilinged "mezzanine" and the probability of death or serious injury to the firemen. Two small windows in the "mezzanine" were broken out from the seventh story and the 100-ft. aerial ladder set



MEZZANINE FLOOR PLAN

in the court to attempt extinguishment through the small windows. At 3:00 P.M. ice conditions made removal of this ladder essential and a 65-ft. aerial was substituted.

When Chief Hugh Fisher was overcome by smoke and taken to the hospital at 5:46 P.M., Ass't. Chief Charles Decker was in command. At 8:30 P.M. approximately three bays in the northeast corner of the seventh floor collapsed and the fire vented itself through seventh floor windows, and spread to the west to meet the fire which had involved the seventh story through the stairway from the "mezzanine."

Shortly after 10:00 P.M. State Fire Marshal Arnold C. Renner called Jackson and Grand Rapids and obtained additional pumper and aerial ladder equipment. Ass't. Chief Decker was authorized to obtain help from Battle Creek and Flint. Both cities sent 100-ft. aerial ladders to the scene.

A representative of a local building contractor suggested that the company's crane could be improvised as a water tower, and two companies provided three cranes which were put to use, as it was obvious by this time that the fire could be extinguished only through seventh story windows. A crane with a 118-ft. boom was most useful, as water could be discharged directly into seventh story windows.

At midnight, the fire had spread to the central elevator section of the "mezzanine," burrowing through the mass of combustibles stored within the screened enclosures. At approximately 2:00 A.M. the fire spread rapidly throughout the balance of the south wing of the "mezzanine" story, though much of the seventh story immediately above was little damaged. It was not until 7:35 A.M. that firemen felt that it was safe to make a new entry into the "mezzanine" story from the central stairway, their activities being coordinated through the effective use of Michigan State Police "walkie-talkies."

Throughout the night, Fire Marshal Renner borrowed more than 400 tarpaulins from local building contractors, factories and others and these were used

throughout the lower stories of the building and appreciably reduced water damage in the building. Earlier in the day, 70 salvage covers were placed in the sixth story by the Lansing Fire Department.

The presence of the wire mesh enclosures and the rubble from the collapsed floor areas made overhaul of the fire the next day exceedingly dangerous without additional support for the seventh floor. A vault in the south corridor of the seventh story had collapsed from failure of supports and heavy loading at 8:45 A.M. Contractors patent shores were installed in the sixth story and mezzanine corridors before overhauling could be safely carried on. Water had accumulated in some sections of the mezzanine story to a depth of 12 to 18 inches, and in varied depth throughout the lower stories and basement of the building.

The Lansing Water Department reports that 4,960,000 gallons of water were pumped during the fire. The supply was adequate, nine pumping engines were utilized to supply 9 hose streams, principally discharged into the seventh story due to the inaccessibility of the "mezzanine" story. Six aerial ladders and three contractors' cranes were in service. The last engine company was returned to quarters at 5:11 P.M. February 12, and a three-man patrol made hourly inspections of the building until 3:15 P.M. on February 17.

Michigan State Police

Contractor's crane with 118-ft. boom was a successful improvised water tower used to reach the seventh story in the fire at the State Office Building, Lansing, Michigan, February 8, 1951.

Pat Mitchell

Nearly 500 salvage covers and tarpaulins were used to protect office contents in all stories beneath the mezzanine story of the State Office Building, Lansing, Michigan, February 8, 1951.

Building Loss

It is estimated that the building loss will exceed $2,500,000 as the "mezzanine" and seventh stories will have to be removed. The Lansing Fire Department estimates that more than 20,000 sq. ft. of the underside of the seventh floor slab were severely damaged or will have to be replaced due to spalling of concrete and the consequent failure of columns, beams and joists. Water damage to suspended metal lath

Pat Mitchell

Typical appearance of mezzanine story of State Office Building, Lansing, Michigan, following fire on February 8, 1951. Note spalled hollow tile filler in seventh floor assembly and exposed reinforcing bars in joists.

Michigan State Police

Records destroyed in sub-standard filing cabinets located in mezzanine story of State Office Building, Lansing, Michigan, February 8, 1951. Wire enclosures and methods of storing broke up hose streams when firemen attempted extinguishment.

Michigan State Police

The northeast corner of the seventh story of the State Office Building, Lansing, Michigan. The floor in the background (40 ft. x 60 ft.) collapsed into the mezzanine story below at 8:30 p.m. on February 8, 1951.

and plaster ceilings throughout the lower stories of the building was severe. It is estimated that as high as 90 per cent will require patching or replacement. There was also considerable water damage to electrical equipment, elevator door motors, etc. Sections of the exterior curtain walls were saturated, and due to heavy icing conditions portions may have to be removed and rebuilt. It is reported that the "mezzanine" and seventh stories will not be rebuilt, and that the building will be reroofed above the sixth story. Oddly, the roof structure over the seventh story was only very slightly damaged due to the protection afforded by the suspended metal lath and plaster ceiling beneath it, although approximately 60 per cent of the seventh story area was burned out.

Other Loss

Costly though the building loss from this fire may be, it is minor when the direct and indirect losses of records, etc., are contemplated. Such losses must be *considered;* they cannot be accurately *estimated!* The indirect losses which may, in the aggregate, total millions of dollars over a long period of years, are of even greater significance in the light of repeated recommendations for corrective measures which, for whatever reason, were not thought sufficiently necessary to warrant the expenditure of public funds to make the improvements.

Major departments occupying the building were these: accounting, administration and budget, banking, building office service, conservation, corrections, highway, insurance, public service commission, purchasing, tax appeals board, tax commission, workmen's compensation and the State Library (first story and part of the basement). All except the State Library were forced to evacuate the building to temporary and inconvenient offices all over the community at rental expense for an in-

Pat Mitchell

Floor beneath the vault in southeast area of the seventh story collapsed at 8:45 a.m., February 9, 1951, following failure of a column (right center) and beam in the mezzanine story below.

Pat Mitchell

Thousands of books had to be transferred from the State Library on the first floor of the State Office Building to the Boys' Industrial School Field House, where they were spread out on bleacher seats to dry.

Michigan State Police

An area of the seventh story of the State Office Building, Lansing, Michigan, occupied by the highway department drafting room (comparatively low combustibility) which burned out from fire transmitted from the mezzanine story through a sub-standard stairway enclosure and collapsed floor slab in the far rear.

definite period. All departments and the State Library lost irreplaceable records, manuscripts, historical documents, files, and other materials in the storage areas in the "mezzanine."*

No department escaped water damage, most less than it might have been had not prompt action been taken to cover desks, files, and other equipment with salvage covers or tarpaulins. The State Library was the hardest hit, as more than 500,000 volumes not including manuscripts, complete back newspaper files, etc., were damp and subject to loss from mildew. An air conditioning unit, scheduled to be installed in a State Prison was diverted to the Library and set up temporarily to assist in the drying out process. Books were transported to gymnasiums and spread out to dry and experts were brought from the Library of Congress in Washington, D. C., to advise and assist in the salvage action necessary.

The dollar loss of contents of the State Library, all of it from water, may reach $475,000.

The Highway Department which occupied the fourth and most of the seventh stories lost plans, surveying notes, etc. It will be several months before a determination of the loss can be made.

Many similar stories of dislocation of other departments occupying the building can be cited to show the inadequacy of the record storage facilities and the incalculable aspects of this loss.

*See *Protection of Records* (NFPA No. 232), Vol. III, National Fire Codes (1951), Building Construction and Equipment. Also published in separate pamphlet form. $1.00.

Special acknowledgment for their assistance in the preparation of this report is made to Arnold C. Renner, State Fire Marshal; Chief Hugh Fisher; Ass't. Chief Charles Decker; Fire Marshal Ernest Kopietz of the Lansing Fire Department; E. E. Hotchin, The Mill Mutuals Agency; R. C. Loughead, Chief Engineer, Michigan Inspection Bureau.

The Natal Mercury

Flaming deck of tanker soon after an explosion occurred during unloading operations at the Oil Terminal Wharf in Durban, South Africa, on November 30, 1950. Two men were killed when trapped in flames on the main deck. Note how flaming gasoline spread fire to open space between the wharf and the ship. Durban Fire Brigade and oil company fire fighters brought the flames under control in 2½ hours, using chemical and mechanical foam and water spray.

Foam Fire Protection For Tankers

EDITOR'S NOTE: During the past month the Editors received, on the same day, two manuscripts dealing with different aspects of the use of foam for fire protection of tank vessels. Despite the fact that one of them came from Durban, South Africa, and the other from Philadelphia, the correlation that exists between the two stories has prompted us to publish them together.

The Durban Story

Based on Information Submitted
By Alfred H. Taylor
Inspector, Durban Fire Brigade

A 10,576-ton tanker* owned by the Norwegian firm Skibs A Solvang, arrived at the Oil Storage Depot in Durban Harbor (Island View Wharf) at 1:30 P.M. on November 30, 1950, with a cargo of about 133,000 barrels (5½ million gallons) of high octane petrol from the Persian Gulf. The 523-ft. vessel berthed alongside the unloading facilities of the oil terminal and began discharging its cargo about 3:00 P.M. A "security guard" of two firemen from the Durban Fire Brigade was posted, one on the vessel and the other on the quay, to supervise and safeguard the operation, as was customary.

The petrol transfer was being accomplished through two 12-inch discharge lines having flexible ship-to-shore connections, using the vessel's own pumps, and continued until approximately 10:25 P.M. without incident. The first indication that anything was wrong occurred as the two firemen were changing positions and both were aboard the tanker. They noticed, at this time, a small flame gushing out of the plug hole of hatch No. 9, which was the farthest aft and nearest to the ship's pump room. Under this hatch were three tanks of petrol. Before any preventive action could be taken, an explosion occurred. One of the fire fighters and a crew member were blown overboard to be later rescued, but the second fire fighter and another crew member were enveloped by the resultant gush of flames and were burned to death.

Preparedness for such a disaster was well organized. An immediate call was sent to the Durban Fire Brigade headquarters while responsible dock-side officials mobilized the oil company fire crews and equipment. A stand-by harbor tug, equipped with chemical foam producing compounds and apparatus, was despatched to the scene without delay. When the fire fighting commenced, however, the flames were mast high, issuing from the No. 9 hatch and, because the vessel listed to starboard almost immediately, flaming gasoline was flowing from the deck into the water between the ship and the quay.

Chief Fire Brigade Officer S. A. Seamer, in consultation with the ship's master and harbor authorities, directed the Fire Brigade to press the attack from the quayside

*The vessel was a Type T-2 tanker built in Sausalito, Calif., in 1945, but at the time of this accident was being operated under the Norwegian flag.

November 30, 1950. Two men were killed when trapped in flames on the main deck. Note how flaming gasoline spread fire to open space between the wharf and the ship. Durban Fire Brigade and oil company fire fighters brought the flames under control in 2½ hours, using chemical and mechanical foam and water spray.

Natal Daily News

Firefighters applying foam from quayside during advanced stages of the fire aboard the tanker in Durban. Tower of flame is issuing from No. 9 hatch but this was subsequently subdued and the fire extinguished with a loss of only about 8,500 of 3,500,000 gallons of petrol aboard the vessel.

while the fire fighting tug operated from the seaward position. The land apparatus used mechanical foam on the tanks initially involved (under No. 9 hatch), while cooling water streams were used on the forward tanks and water-fog was directed on the spill areas between the ship and the shore. While this close approach was being maintained, the danger of a partially empty tank exploding was obviously very serious. About two million gallons of petrol aboard had been discharged since the vessel's arrival and there was no way of telling in which tanks an explosive vapor-air mixture existed. In addition to the danger of a second explosion, the danger of expansion and ignition of the petrol still aboard the vessel could not be overlooked.

Despite the hazards, the foam attack was pressed with increased vigor. Within about 25 minutes it was possible to approach close enough to find the two victims on the deck. The perimeter of the fire area was constantly narrowed by the foam attack but great columns of fire continued to issue from the No. 9 hatch for the next hour-and-a-half.

Within this period, however, the fire was brought under control and total extinguishment was secured two-and-a-half hours after the initial outbreak. Regardless of the fact that the tug was using chemical foam and the land fire fighting was done with mechanical foam, no noticeable breakdown was observed due to the admixture.

Overhaul after the fire revealed that only one tank had been seriously affected. It was estimated that about 8,500 gallons of petrol were consumed in the fire from this tank and about 10 gallons were lost

from each of the two adjoining tanks. The prompt control and extinguishment is a tribute to the progressive, manual fire fighting accomplished by the Durban Fire Brigade, to the vent design safeguards engineered into the vessel, and to the effective employment of foam and supplementary fire extinguishing agents.

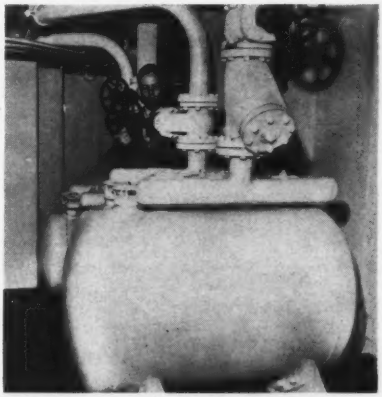
The Philadelphia Story

Based on Information Submitted
By J. Howard Myers
Director, Safety and Fire Prevention Division
Atlantic Refining Company

While the fire on the Norwegian tanker in Durban, South Africa, was being brought under control, a new tanker, the *Atlantic Seaman,* was peacefully sliding down the ways on the same day, November 30, 1950, in the Camden, N. J., yards of the New York Shipbuilding Corporation.

This tanker, the first of three sister ships (the last of which was commissioned this March), is the largest type oil tanker ever to float in world commerce and is the first to have a complete mechanical foam installation aboard. The 659-ft. vessel has a capacity of 257,000 barrels. She has a breadth of 85 ft. and a loaded draft of 34 ft. The vessel is powered with a 1020° F. steam turbine, the highest temperature steam system ever used on a vessel.

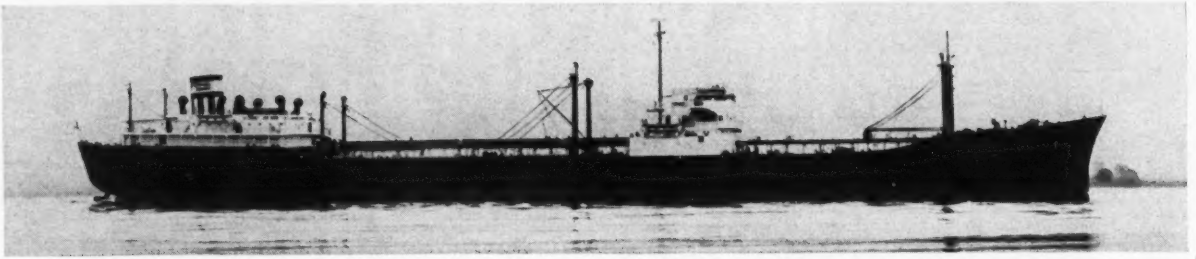
The major fire protection equipment for this 30,000-ton vessel is her mechanical foam installation, supplied by the National Foam System, Inc. Equipment on the main deck protects that area and controls the protection for the lower decks. As shown in the accompanying diagram, two 500 gpm fire pumps supply water for the entire mechanical foam system. Two pressure proportioners are located in a compartment on the main deck aft (100 gal. for small fires, 200 gal. for large fires), and a 20-

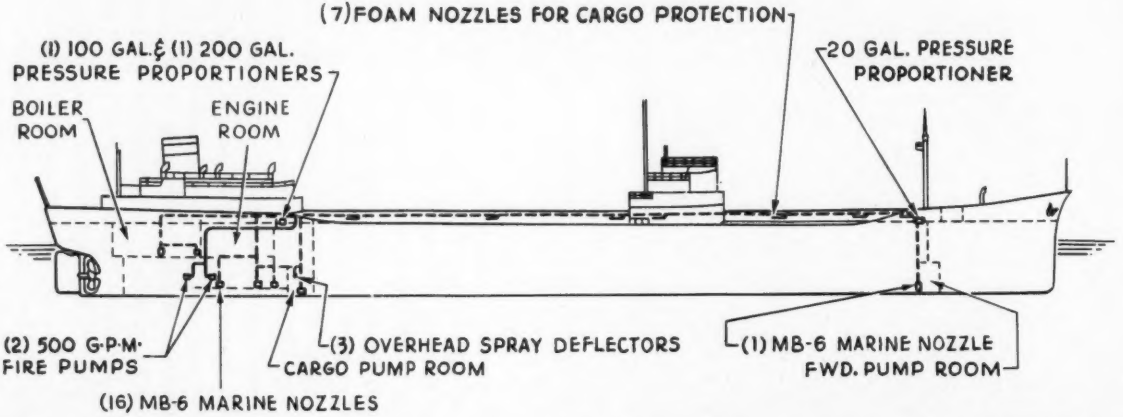


View of foam system proportioners aboard the *Atlantic Seaman.* Forward tank has 200-gal. foam liquid capacity.

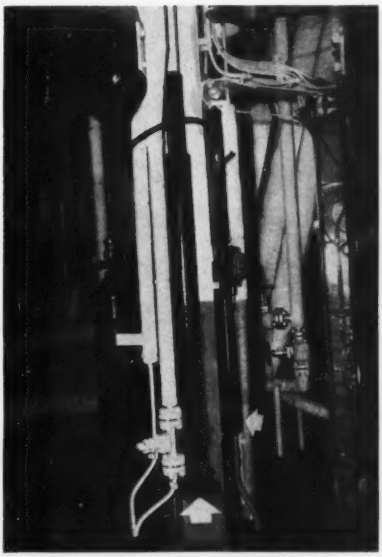
gallon proportioner is mounted on the main deck forward. As water flows from the pumps through the fire main, these proportioners inject the proper amount of foam liquid into the stream to the various foam applicators, located throughout the ship.

Seven foam applicators, which can be readily attached to standard fire hose, are spaced along the catwalk which extends lengthwise down the middle of the *Atlantic Seaman.* Six foam applicators, called marine floor nozzles, are located in the boiler room. These have discharge deflector plates at the bottom placed from 9 to 12 inches above the decking. Eight marine floor nozzles protect the engine room, while the cargo pump room has two floor nozzles and three overhead spray deflectors, the latter giving protection to the pumps themselves and overhead piping, as well as the floor area. The forward pump room is also protected by one floor nozzle. All of these floor nozzles and overhead spray deflectors can be quickly put into action by the operation of plainly marked valves located in a protected "topside" control room. Auxiliary cans of foam




(7) FOAM NOZZLES FOR CARGO PROTECTION
(1) 100 GAL. & (1) 200 GAL. PRESSURE PROPORTIONERS
20 GAL. PRESSURE PROPORTIONER
BOILER ROOM
ENGINE ROOM
(2) 500 G.P.M. FIRE PUMPS
(3) OVERHEAD SPRAY DEFLECTORS
CARGO PUMP ROOM
(1) MB-6 MARINE NOZZLE FWD. PUMP ROOM
(16) MB-6 MARINE NOZZLES

This vessel, the *Atlantic Seaman*, was launched on November 30, 1950, at Camden, N. J., yards of the New York Shipbuilding Corp., and was built for Philadelphia Tankers, Inc., and chartered by the Atlantic Refining Co. The diagram shows the mechanical foam installation described in this article.



Lower arrow shows marine nozzle for laying foam in boiler room. Note also carbon dioxide cylinders, trunnion reel and nozzle to protect electrical equipment.

liquid are strategically located throughout the vessel for localized fires which do not demand operation of the pressure proportioners and as an auxiliary supply. The total amount of foam liquid aboard exceeds 1,000 gallons. Either fresh or salt water may be used to produce the foam.

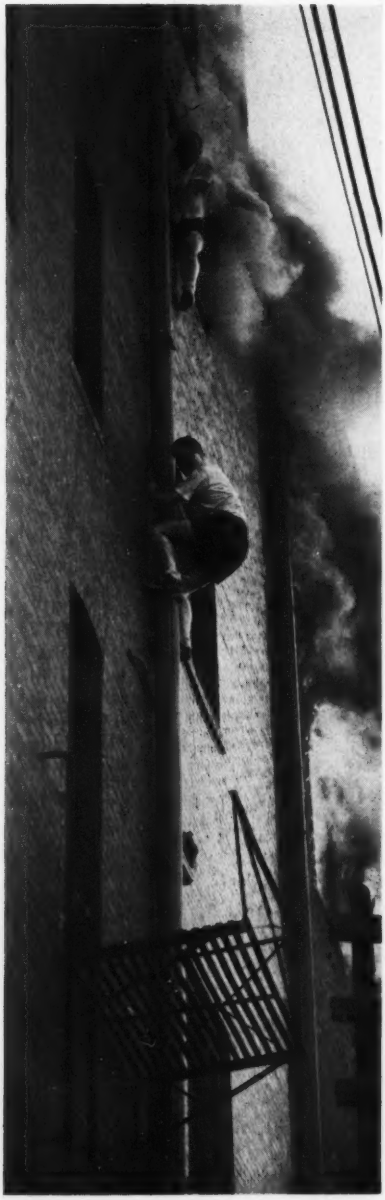
In addition to the piped mechanical foam system, the usual salt water fire main is provided to serve some twenty-nine fire stations throughout the length of the ship. Three of these stations have monitors (starboard forward and port aft ends of the upper bridge deck amidships and on the centerline, forward of the poop deck house). All fire stations, except engine and boiler rooms, utilize combination solid stream and spray nozzles, the two exceptions being fitted with water spray nozzles only. Ten-foot applicators are provided in six locations and a six-foot applicator is located in the crew quarters, aft.

Paint and lamp lockers in the forecastle are protected by a piped carbon dioxide system (manual controls) while the electrical switchboard and generators in the engine room also enjoy carbon dioxide protection. Hand fire extinguishers are also liberally provided at various locations around the vessel.

Cargo tank venting is provided by a closed system. Each cargo hatch is fitted with a six-inch vent and vacuum valve connected to a vent header system which terminates in risers at the top of the kingposts. These risers are equipped with flame arrestors. The cargo pump room is ventilated by means of two 24-inch kingpost vents with cowls and turning gear, and positive circulation is secured for this room by means of steam or air operated ejectors.

It is obvious that the designers and operators of this vessel mean to provide facilities to cope with any fire emergency which might develop in the handling of the hazardous cargo she was designed to carry. With the coincidence of the fatal fire on the Norwegian tanker, occurring halfway around the world on the same day, emphasis is placed on the expectation that fire fighters at all ports of call of the *Atlantic Seaman* should have less risk to face in handling fires aboard this newest American tanker.

Denver Athletic Club Fire



Fire caused four deaths and $340,000 property damage at the Denver Athletic Club, Denver, Colorado, Feb. 17, 1951.

The 50-year-old 5-story brick, wood-joisted building occupied by the club had just been reopened following extensive repairs and was to be the scene of the grand reopening Saturday evening, February 17. The banquet and dance were to be held in the 4,000 sq. ft. 25-ft.-high gymnasium in the second story. Combustible drapes were hung from the balcony to within four ft. of the floor on all walls of the gymnasium. Streamers were festooned, tables were set up and gaily decorated; in fact everything was in readiness at 3:00 P.M. for a gala evening when fire broke out at a public address system speaker. Short circuit at the speaker is the reported cause. Within minutes fire flashed over the drapes encircling the room, flaming streamers fell on tables and tablecloths ignited. One can easily visualize the panic that might have resulted had this fire occurred during the banquet and dance.

Although the fire was discovered promptly by an employee the alarm to the fire department was delayed several minutes as the employee first tried to find an extinguisher hidden by the drapes and then ran down the hall to get another. On his return the fire was beyond control in the gymnasium and before apparatus arrived had extended through air conditioning ducts to the attic and was spreading up an open stairway to upper stories. Several of the 100 people in the building, on being alerted by the manually operated fire alarm bells, were able to escape down an enclosed stairway and via an elevator. The rest were trapped in rooms on upper stories as smoke, heat and flames rapidly made corridors impassable. All but four of those trapped were rescued over extension ladders or escaped down outside fire escapes and drain pipes. Overhead wires, suspended from five crossarms on twin poles in the rear alley hindered placement of fire department ladders.

The 3-M Explosion

By Stanley Earle,
NFPA Flammable Liquids Engineer

At 8:21 on the morning of February 8, 1951, a violent explosion of liquefied petroleum gas vapors in the basement seriously damaged a reinforced concrete building and brought death to 14 employees of the Minnesota Mining & Manufacturing Company in St. Paul, Minn. The property and production loss was estimated at over $1,000,000.

The minerals building in which the explosion took place was approximately 85 ft. by 90 ft. with brick walls and windows set in steel sash (not arranged for explosion venting) as shown in the pictures. The floors and roof were of heavy reinforced concrete with enclosed floor openings which undoubtedly helped to confine the major damage to the lower floors. An adjacent building (No. 20) was connected to the south side of the minerals building at the first floor level with a fire door at the opening.

The minerals building was used for processing non-combustible materials used in the preparation of abrasive products. Heat treating and burning furnaces located on the 4th and 5th floors used butane gas as fuel. Electric fixtures were of the ordinary type and the building was not sprinklered because of the non-combustible construction and processes.

Emergency Procedure

This plant had used butane extensively since 1928 without accident and the plant mangement had outlined a procedure to be followed in the event that a gas leak was discovered. The procedure was briefly as follows:

1. All personnel in the area to be alerted.

2. The Safety Engineering Department and the Maintenance Shop to be notified by telephone or runner (whichever was fastest).

3. Extinguish all flames and eliminate sources of ignition.

4. Close master control gas valves.

5. A safety inspector, using a gas analyzer, and a maintenance man to determine the hazardous area.

6. Following these precautions the leak to be detected and repaired.

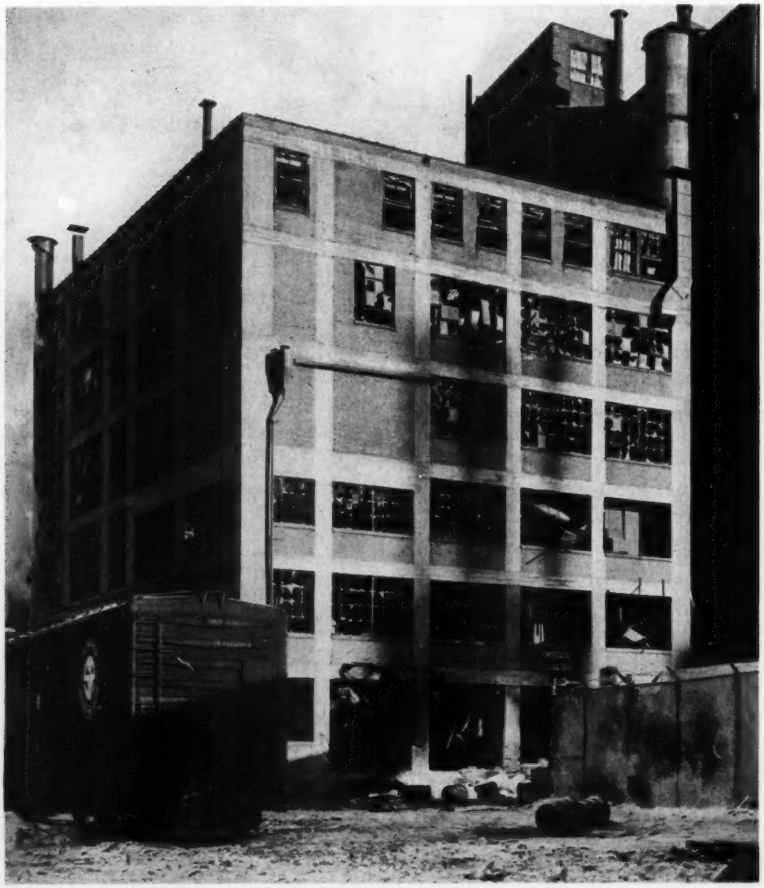
A 14,000-gallon butane storage tank was located 80 ft. west of the minerals building and was enclosed by a heavy wire mesh fence. Liquid butane was piped underground through piping adjacent to the north foundation of the minerals building to the vaporizer located to the east of the minerals building.

Butane gas from the vaporizer was piped into the minerals building at the first floor level and the butane line then passed into the basement and then up to the furnaces of the upper floors. There were no gas outlets required or provided in the basement. Gas shut-off valves were provided both inside and outside the minerals building near the point of entry into the building.

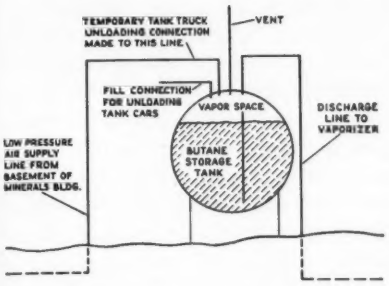
Liquid butane was usually received by tank car and transferred to the storage tank by a pump. All butane unloading was done by authorized plant personnel.

Railroad Strike

Due to transportation difficulties occasioned by the existing railroad strike it was necessary to have liquefied petroleum gas delivered by tank truck and a temporary unloading connection was installed on the butane storage tank to accommodate the tank truck. In addition to the usual fill, vent and discharge connections the vapor space of this butane storage tank was connected to a low pressure air supply line (see sketch) so that the butane tank could be pressurized by air in very cold weather for the purpose of transferring liquid butane from the storage tank to the vaporizer. This air supply line was connected to the shop air system and ran underground from the basement of the minerals build-



The Minerals Building of the Minnesota Mining and Manufacturing Co., St. Paul, after the explosion of February 8, 1951, in which fourteen men were killed and damage of over $1,000,000 occurred. Windows were not of the explosion venting type.


TEMPORARY TANK TRUCK UNLOADING CONNECTION MADE TO THIS LINE.
VENT
FILL CONNECTION FOR UNLOADING TANK CARS
VAPOR SPACE
DISCHARGE LINE TO VAPORIZER
LOW PRESSURE AIR SUPPLY LINE FROM BASEMENT OF MINERALS BLDG.
BUTANE STORAGE TANK

Schematic arrangement of fill, vent, discharge and air line connections on butane storage tank.

ing to the butane storage tank. A water condensate leg with a drain valve was connected to the air supply line in the basement of the minerals building.

Just before the explosion a tank truck containing liquefied petroleum gas (stated to be 70% propane and 30% butane instead of the usual 100% butane) containing odorant was connected to the temporary filling connection at the storage tank and the transfer of the fuel was started. The temporary filling connection was arranged so that liquefied petroleum gas could be pumped from the tank truck into the low pressure air supply line at a point close to the butane storage tank. It was intended that the liquid fuel would pass through a short section of the air supply line and into the storage tank.

Shortly after the unloading operations began and several minutes prior to the explosion an employee reported a serious leak of gas in the basement to a foreman in the minerals building. A man was immediately dispatched to notify the Safety Engineering Department and then to get assistance from the maintenance shop according to the outlined procedure. This man notified the Safety Department and was told to go at once to the near-by maintenance shop, which he did. He met the steamfitter foreman, who, on learning the situation, started on the run for the minerals building. Before he reached it the explosion took place and he at once ran to the vaporizer unit and shut off the gas from the entire system. He then rushed to the butane storage tank and made sure the butane discharge valve was closed.

When the explosion occurred the unloading of liquefied petroleum gas from the tank truck was discontinued immediately.

All employees in the lower floors of the minerals building were killed and what progress they had made to eliminate ignition sources, etc., in the interim between the discovery of the gas leak and the explosion is not known.

The first and second floors with the equipment stored thereon and in the basement were completely destroyed. The pic-

A close-up of the damage near the seat of the explosion.

The explosion presumably originated at the corner of the building. Butane storage tank in right background.

tures clearly show how the walls of the first floor and the aboveground portions of the basement walls were blown out. The upper floors and equipment thereon were not seriously damaged but almost all of the windows and about three-quarters of the steel window sash were destroyed.

The St. Paul Fire Dept. responded promptly and extinguished a small fire in the minerals building and a fire involving rolls of paper in the adjacent building No. 20. They and plant personnel are to be commended for their efficient work following the explosion under very difficult conditions including sub zero weather.

How It Happened

A study of the arrangement of the temporary fillings connection on the air supply line at the butane storage tank revealed that it was possible during the unloading operation for liquefied petroleum gas to flow back into the underground air supply line. With an open drain valve on the water condensate leg gas could thus enter the basement of the minerals building. It was concluded that liquefied petroleum gas entered the basement of the minerals building by means of this air supply line and condensate leg and was ignited by one of several ignition sources which existed in the basement.

The buried butane line adjacent to the north foundation of the minerals building was pressure tested after the explosion and was found to be intact with no leaks, and this would eliminate the possibility of liquefied petroleum gas entering the basement from this source.

The possibility of a leak in the gas piping inside the minerals building was discounted. Temperature recorders on the furnaces in the minerals building indicated no unusual conditions in the gas supply prior to the explosion.

The outstanding lesson of this explosion is the danger of connecting a shop air system to a liquefied petroleum gas system in such a way that the gas can enter the building.

Whenever any deviation from standard liquefied petroleum gas transfer procedures is made necessary because of a change in delivery or operating conditions, extreme caution must be exercised and every operation and valve setting must be double checked in order to prevent explosions or fires.

It is understood the Minnesota Mining and Manufacturing Company has abandoned the use of liquefied petroleum gas in this plant and will use natural gas in the future.

This report records the personal observation of the author who visited the scene of the explosion at the request of Mr. Leonard C. Lund of the Minnesota Fire Marshals' Division. The photographs were furnished by courtesy of the Factory Insurance Association.

Evansville Main St. Conflagration

Shortly after midnight January 4, 1951, a disastrous fire ravaged the center of the principal shopping district of Evansville, Indiana. Two buildings were totally destroyed, six severely damaged and nine slightly or moderately damaged. Preliminary estimates place the loss at $3,000,000. This costly fire was due to a combination of circumstances that has caused many similar conflagrations in the past. The records of municipal fire departments show that buildings of inferior construction and without automatic protection are usually destroyed when fires are allowed to develop undetected. The records further point out that in built-up areas exposed buildings are also likely to be destroyed or severely damaged if standard exposure protection is not provided. In the case at hand, the fire was beyond control in the building of origin when discovered and spread to exposed buildings in the congested business district due to the inadequacy of walls or absence of protection for window, door and other openings.

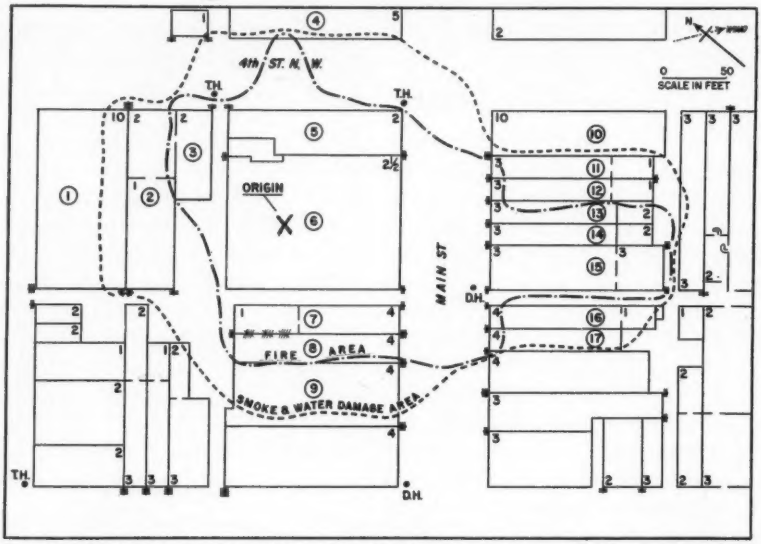
Based upon report submitted by the Indiana Rating Bureau.

Construction

The buildings involved in the fire are shown on the accompanying diagram. The fire originated in No. 6, a 62-year-old unsprinklered 2½-story building of 15,500

Acme

Economy Department Store, where fire originated, in right foreground. Before apparatus arrived flames had spread to the building at left through plain glass windows.



Area involved in the Evansville Main St. Conflagration, January 4, 1951. Building No. 6 was the Economy Department Store. Note how fire spread across 75 ft. wide Main Street and 60 ft. wide 4th Street.

sq. ft. ground floor area. The front wall facing Main Street consisted of iron columns and glass windows on the first floor, wood framing with metalclad covering above. Otherwise construction was brick, wood-joisted with roof and floor joists supported by iron columns, wood posts and brick piers. Exterior walls were replete with unprotected openings, floor areas were undivided, and stair and elevator shafts were open. The Economy Department Store occupied the building for retail sale of wearing apparel and home furnishings, much of the stock in the basement and first stories being on open counters.

Buildings No. 1 and No. 10 were each 10 stories high, of fire-resistive construction with all openings in the walls exposed by this fire protected by wired glass windows in metal sash and frames. These protective features prevented fire from entering these two structures.

All other buildings in the fire area were of brick, wood-joisted construction, two to four stories high. Walls were mostly 12 inches thick, and in a majority of cases party walls separated adjoining buildings. The party walls dividing the group of buildings on the south side of Main Street (Nos. 13, 14 and 15) were 16 inches thick in the first story and 12 inches in the second and third stories, and 8 inches thick in the attic. This party wall construction (substandard according to the National Building Code of the National Board of Fire Underwriters) was an important factor in the spread of fire from one to another of the three buildings since heat was transmitted through walls at the attic level and ignited roof joists of adjoining buildings.* Occupancies of the various buildings were typical retail shops found in city central shopping areas.

*Presumably the framing of wooden beams or girders into the wall without adequate separation was a factor.

The Fire

Everything was apparently in order when the Economy Department Store closed its business day as usual Wednesday evening, January 3. The manager was the last to leave, about 6:10 P.M. Seven hours later the building was belching flames through its roof and many windows. There was no watchman or automatic protection equipment provided, the safety of the store being left to a merchant policeman. The latter passed the store at 12:25 A.M. and 12:35 A.M., noticing nothing unusual on either occasion, and first learned of the fire from the sirens of responding apparatus. The fire was discovered and the alarm transmitted simultaneously by two police patrol cars at 1:30 A.M. Other alarms were received at about the same time. An indication of the extent of fire when discovered was the fact that the call for second alarm apparatus was transmitted by the assistant chief while en route to the fire.

Before the arrival of the first company, fire had broken through the roof of No. 6 and had leaped across the back alley and east courtyard to enter buildings No. 3 and No. 5 through plain glass windows. Within 20 minutes the Economy Department Store collapsed. Intensified by a 15 mph west northwest wind, flames and intense heat swept across 75-ft. wide Main Street and entered wood framed ordinary glass windows in the second and third stories of building No. 15 (clothing store). Although intense heat prevented firemen from attacking the fire from Main Street an effort was made to direct streams into the second and third stories of building No. 15 from an alley fire escape. However, excessive heat soon forced firemen to retreat. Other lines were brought to bear from roofs of surrounding buildings, from distant points in the street and from the alley in the rear but flames could not be prevented from involving the entire structure, and penetrating the 8-inch-thick wall in the attic and igniting roof joists of No. 14. Fire traveled in a similar manner to No. 13. Fire was prevented from further spread to the east by hose streams and the 12-inch party wall at attic level between No. 13 and No. 12. However, intense heat cracked practically all wired glass windows in the upper stories of the 10-story fire-resistive building No. 10. Heavy hose streams in the alley in the rear of Nos. 13, 14, 15 and in the alley at the side of No. 15 prevented spread to buildings at the south and west. Early in the fire flames jumped the 16-foot alley between No. 6 and No. 7 and entered the latter 1- and 4-story building through unprotected plain glass windows. Fire entered the attic of the 4-story building No. 8 through three small unprotected openings overlooking the 1-story section of No. 7 and also within range of the fire in No. 6. Fire also entered No. 7 from No. 8 by heat transmission through the 12-inch party wall separating the fourth stories of the two adjoining structures.

Spread to the north was stopped at No. 2, which sustained slight damage to the attic caused by heat transmission through the wall separating No. 2 from No. 3. Wired glass metal sash windows in the exposed wall of the 1-story section of No. 2 were intact. Further demonstration of the value of wired glass window protection was given by the wired glass windows in the upper stories of the exposed wall of No. 1. Practically all were cracked by the heat but no fire entered the building.

Fire jumped across 60-ft.-wide 4th Street, entering a few small rooms in the third and fourth stories of No. 4. These fires were extinguished in their incipiency

Wide World

This aerial view illustrates graphically the extent of damage to buildings on all four sides of the building of origin that stood on the smoldering leveled area in the center of the picture.

by firemen using hose lines brought into the building.

Fire Equipment and Manpower

The first alarm brought five pumpers and two ladder trucks, the second two more pumpers, and special calls within six minutes of the first alarm summoned four additional pumpers. With fire beyond control in the building of origin and spreading in all directions soon after apparatus arrived it became apparent that help from surrounding communities would be needed. In answer to calls sent out shortly after 2:00 A.M. seven towns within a radius of six to forty miles sent equipment and manpower. This outside aid was coordinated well into the plan of attack and was a valuable factor in bringing the fire under control. A total of 255 men fought the fire including 176 local firemen, 39 out of city firemen and 40 local auxiliary men and soldiers. Hydrants were sufficient in number, well placed and supplied ample water for the 16 pumpers with total pumping capacity of 8,500 gpm working at the fire. Twelve thousand, five hundred feet of 2½-inch hose, 200 ft. of 3-in. and several hundred feet of small hose were used by the Evansville department. Total length of ladders used was 900 ft. Five deluge pipes including one on each of two 100 ft. aerial towers were used throughout the fire. In all, 7,000,000 gallons of water were used before the fire was finally brought under control at 7:00 A.M. and extinguished at 10:32 A.M.

North LaSalle St. Fire, Chicago

Three Chicago firemen and one member of the Chicago Fire Insurance Patrols were killed when parts of two walls collapsed during the early stages of fire in a multiple tenant building in Chicago, January 12, 1951. Property damage is expected to exceed $1,500,000. In all probability this loss of life and property damage would not have occurred had two fundamental principles of fire protection been applied: provision of automatic sprinklers and enclosure of vertical openings. As in most serious fires in congested built-up areas, exposed buildings were threatened by the raging fire in their midst. That these buildings were not involved is a tribute to the efficient work of the Chicago Fire Department and to effectiveness of wired glass windows in metal frames. Through the medium of television this fire was seen by an estimated 5,000,000 people, the largest audience ever to witness a fire disaster.

Construction and Occupancy

The 75-year-old unsprinklered 4-story brick, wood-joisted building was approximately rectangular in shape, bounded on the 164 ft. front by N. LaSalle Street, on one 200 ft. side by W. Carroll Ave., and on the other by the Chicago River. A 10-ft.-wide alley separated the rear wall from a 9-story fire-resistive multiple occupancy building. Construction was brick, wood-joisted with wall thicknesses 12 inches on the fourth floor, 16 inches on the third and second and 20 inches on the first floor and basement. The roof was composition on 1-inch boards on ordinary joists. Vertical openings were either unprotected or improperly protected, and openings in a fire wall that divided all floors into front and rear sections of 8,800 sq. ft. and 24,000 sq. ft. areas respectively were not protected by automatic fire doors. Numerous tenants occupied all floors and the basement for storage, shipping, manufacturing and office space. Among the combustible materials manufactured or stored in the building were packing materials, draperies, bedding, office supplies, artificial flowers and various food products.

The Fire

At 2:04 P.M. an employee of one of the tenants noticed smoke from fire that apparently originated in the rear section of the first story near a shipping platform. This area was occupied by the B. F. Goodrich Co. for storage of automobile accessories. The alarm was telephoned without delay and the first arriving engine company used a 2½-inch line to extinguish fire in the first story in the immediate vicinity of the shipping door. It was then that firemen discovered that fire had spread undetected to the second story through unprotected openings. A hose line was taken up the outside fire escape to the second floor and when entrance could not be gained through the fire escape door an adjacent window was broken and water directed at the visible flames in the smoke-filled second story. At this point the entire second story burst into flames. Firemen were ordered from the fire escape and the first box alarm was struck. The second alarm was struck four minutes later at 2:25 P.M.

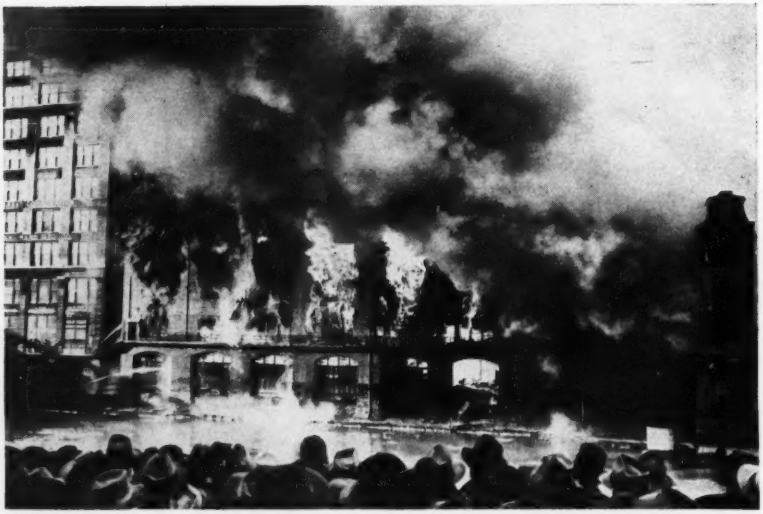
Based upon reports submitted by the Chicago Fire Department and the Cook County Inspection Bureau.

International

Four firemen in the street were killed when an explosion of fire gases in the top story blew out parts of two walls. At the time of the explosion fire had not spread above the second story. A 10-ft. alley separated the burning building from the 9-story fire-resistive building in the background.

International

Wired glass windows in conjunction with a water curtain formed by fire boat and land company hose streams prevented fire from entering the 9-story fire-resistive building at left. Wind-carried embers that landed on the roof of the 24-story fire-resistive Merchandise Mart (left background) were quickly extinguished by employees using first aid equipment.



Acme

Unprotected vertical and horizontal openings and lack of sprinklers were vital factors in this fire at Chicago, Jan. 12, 1951. Four firemen were killed when an explosion of fire gases in the top story blew parts of two walls into the streets.

In the meantime members of the squad company responding to the still alarm had proceeded to the roof of the rear section to ventilate. Large quantities of heavy yellow smoke (products of incomplete combustion) issuing from the various roof openings, however, made their position untenable and forced them to the roof of the front section. They were climbing over the fire wall parapet when the roof of the rear section collapsed as the fourth story walls at the rear and W. Carroll Ave. sides fell out. Three firemen and one member of the fire insurance patrol were killed by the falling bricks; seven firemen were injured. The collapse of the roof and walls is attributed to an explosion of combustible gases generated by the fire in the first and second stories. Openings made at lower floor levels and the roof are believed to have allowed suffiicent air to reach the hot fire gases to form an explosive mixture.

The explosion occurred at approximately 2:35 P.M., after which fire immediately spread to all parts of the undivided building through fire wall openings and open stair and elevator shafts. A third alarm had been sounded at 2:29 P.M. In the 20 minutes following the explosion two additional box alarms and three special calls were sounded. A total of 38 engine companies, 2 fire boats, 5 ladder trucks, 6 squad companies, 3 high pressure wagons, 2 water towers and 3 fire insurance patrols responded.

With no chance of saving the building of origin firemen confined their efforts to preventing spread to other structures. Although most streams were directed into the burning building from the two streets

and the river, several large hose streams from the fire boat *Joseph Medill* and land companies formed a water curtain in the alley at the rear to protect the exposed wall of the sprinklered 9-story fire-resistive building. Despite the proximity of the intense fire and notwithstanding the fact that the wind drove heat and flames directly at the exposed wall, the combination of the water curtain and wired glass windows at all exposed openings was so effective that no fire entered and no sprinklers opened.

When the severity of the fire became apparent roof sprinklers were turned on and employees were stationed on the roof of the 24-story Merchandise Mart, 80 ft. beyond the 9-story fire-resistive building and also in direct line of wind-carried smoke and embers. Several burning embers landed on the roof but were quickly extinguished by employees using first aid equipment.

Several surrounding buildings suffered an as yet undetermined amount of damage from smoke and water that entered through a freight service tunnel operated by the Chicago Tunnel Co. Some 51 buildings including the fire building were served by the tunnel and 13 of them received their air supply for ventilating systems from the tunnel. Six miles of tunnel were flooded by water from hose streams.

Baltimore Pier Fire

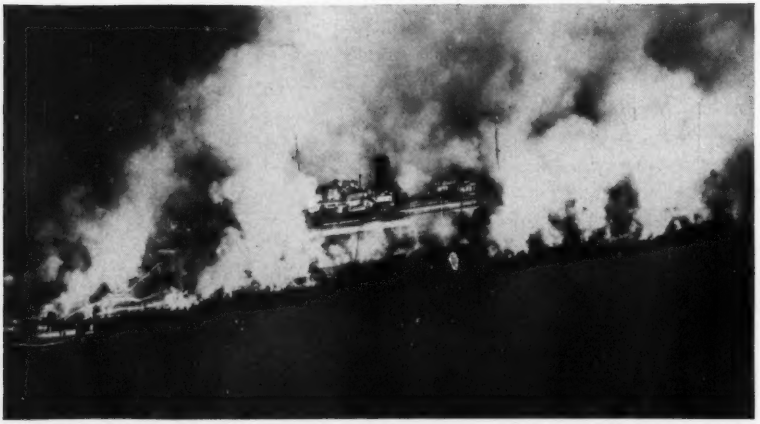
A 1,200-ft.-long U. S. Government pier, the decommissioned 25,000-ton troop transport *George Washington,* one tug, two barges and a floating pile driver were destroyed by fire at Hawkins Point, Baltimore, Maryland, January 16, 1951. Loss is estimated at $10,300,000. Failure to maintain substructure sprinkler equipment and its water supply in operating condition was largely responsible for destruction of the pier. Loss of the 42-year-old German built troop ship is directly attributed to the absence of someone in responsible charge with authority to make decisions affecting the safety of the ship.

Built during World War II at a cost of $5,000,000 for ammunition loading, the pier was shared at the time of the fire by the U. S. Maritime Commission and the Merritt, Chapman & Scott Corp. The offshore 700 ft. was used by the Commission to berth the decommissioned transports *George Washington* and *Edmund Alexander.* Skeleton crews were maintained on both ships. The in-shore 500 ft. was occupied by the construction firm for loading and unloading railroad cars and barges by means of railroad cranes, the material handled to be used in the construction of the Chesapeake Bay Bridge. One tug, two barges and a floating crane owned by this company were tied up to the pier when the fire broke out.

Construction

The 1,200 ft. by 90 ft. pier was surfaced with a concrete deck laid on 2-inch planks on wood beams and girders set on wooden piles. A trestle 160 ft. long by 41 ft. wide, of similar construction, connected the pier to the mainland. Draft stops constructed of loosely fitted 2-inch by 6-inch planks

Based upon reports submitted by the Baltimore Fire Department and the Maryland Fire Underwriters Rating Bureau.



Baltimore News-Post

Failure to maintain the substructure sprinkler system in operative condition allowed fire to spread beyond control beneath the concrete deck of this 1200-ft.-long pier, out of range of land company hose streams and fire boat turret nozzles.

were located at approximately 150 ft. intervals in the substructure. Except for two small wooden washrooms on the trestle there were no superstructures on the pier or trestle.

Fire Protection

Wet pipe sprinklers (dry in winter), manually controlled through the pier fire alarm system and supplied by a looped 8-inch transite main, formerly protected both sides of all draft stops in the substructure. However, the system was not in operating condition at the time of the fire and had not been since 1947. Piping had been damaged by freezing, numerous sprinkler heads had been stolen and the sources of supply for the system, two 1000 gpm fire pumps taking suction from Baltimore Harbor, had also been allowed to deteriorate and were not in operative condition. Two hydrants, the nearest more than 1,000 ft. from the pier, were connected to yard mains supplied by the two fire pumps and by a 10-inch city water main. The hydrants were also inoperative. Valve stems were bent, valves broken and one hydrant knocked out of plumb.

The Fire

At approximately 4:00 P.M. smoke and flames were observed issuing from beneath the pier by several construction firm employees and transport ship guards. The fire was then burning in the pier substructure about 200 ft. from the land end. Alarms transmitted without delay via a fire alarm box and telephone brought three engine companies, one ladder truck and one fire boat. Due to the construction of the substructure, oil covered pilings, high winds and delayed apparatus response occasioned by heavy traffic, flames had spread in both directions and involved 250 ft. of the substructure before the first engine company arrived.

Within 2½ hours of discovery four fire boats and 53 pieces of land apparatus were at the scene but several factors operated to

reduce greatly the efficiency of this large mobilization of equipment and manpower. With no hydrants available all water used on the fire had to be drafted from the harbor which because of the low tide was not readily accessible. The rated capacities of the pumpers were greatly reduced by the long suction lines required—at least 40 ft. in most instances. As is usually the case with substructure pier fires, water on three sides prevented land companies from directing streams from the most advantageous positions. Fire boat turret nozzles were too high to reach the burning substructure. Hose lines were dragged along the concrete pier deck but could not be discharged on the flames being driven by a 40 mph wind through the substructure. While it may be assumed that the wooden draft stops temporarily retarded the flames, they could not be expected to prevent fire from spreading through and around them in the absence of effective fire fighting. When sections of the pier started to collapse at 8:15 P.M. all firemen were ordered off.

Early in the fire employees of the Merritt, Chapman & Scott Corp. attempted to cut loose the tug and barges tied to the pier but were prevented by heat and flames from getting close enough to do so. These craft later drifted away in flames when the hawsers burned through. No early attempt was made by the skeleton crews aboard the transports to move these vessels since they were unwilling to assume responsibility for moving the ships until permission had been obtained from Washington. Permission was obtained in time to tow the *Edmund Alexander* to safety, but not before wind-driven flames had enveloped the *George Washington* and forced the crew to flee (1½ hours after the fire was discovered). Had steps been taken to move this vessel when the seriousness of the fire first became apparent it is quite probable that it too could have been towed to safety. Four fire boats continued to pump water into the *George Washington* until early morning, when further attempts at control were stopped because of a six degree list. Rather than have the ship capsize and sink it was decided to halt pumping operations and allow the vessel to burn out.

Mt. St. Vincent College Fire, Rockingham, N. S.

Destruction of a group of nine interconnected buildings at Mt. St. Vincent College, Rockingham, Nova Scotia, January 31, 1951, represented the largest single fire loss on record in the Provincial Fire Marshal's office. Building damage alone was conservatively estimated at $1,000,000. Loss to contents including valuable art treasures and books, may exceed $2,000,000. The 300 girl students from kindergarten to college age and the 100 Sisters of Charity in the buildings when the fire broke out escaped without injury because of the location and extent of fire when discovered and because of a well organized, prearranged plan of evacuation. The existence of such a plan indicates that the school authorities recognized the possibility of a disastrous fire. However, the complete absence of major structural fire barriers and automatic fire protection, and the woefully weak facilities for manual fire fighting suggest lack of knowledge of fire protection.

Based upon reports submitted by the Provincial Fire Marshal and the Halifax Fire Department.

Construction and Protection

The interconnected group of buildings destroyed were of brick, wood-joisted construction, 3, 4 and 6 stories in height except for the 2-story wooden addition where the fire originated. Lack of fire walls, fire

Halifax Herald

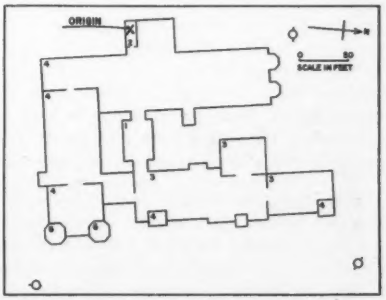
The fortunate discovery of this fire when still confined to the second floor of a 2-story wooden addition permitted the school staff to awaken and evacuate all 300 students before flames spread to the unsprinklered main building. With yard mains unable to supply even one good hose stream, firemen were helpless.

doors and stairway enclosures made the nine structures in effect a single building of 36,770 sq. ft. ground floor area. No automatic sprinklers or automatic fire detection equipment was installed although a manually operated fire alarm system was provided to alert occupants. Three yard hydrants, with hose connections only, were available. Two, fed by a 6-inch main, were supplied by gravity from a 1,000,000-gallon reservoir. The third, on a 4-inch main, was supplied by gravity from a 15,000-gallon reservoir. In neither case was the static pressure sufficient to give effective hose streams. Since Rockingham had no public fire protection, the Halifax Fire Department, 5 miles away, answered alarms at the school.

The Fire

At 1:15 A.M. on noting the odor of smoke, one of the Sisters immediately operated the manual fire alarm system and notified the Halifax Fire Department by telephone. Two pumpers, a ladder truck and rescue squad were dispatched. On arrival firemen found fire confined to the section of origin, the second floor of a 2-story wooden addition in the rear (see diagram) occupied as a carpenter shop. In the words of Deputy Fire Chief Young, "If we had had two strong lines of water in the beginning, we could have saved the main building." As it was, the hydrants were not capable of delivering even one good stream. The 2½-inch hose used to connect pumpers to hydrants collapsed as soon as pumps were operated, and since no drafting source was available, firemen were unable to prevent flames from entering the main building and spreading from one to another of the interconnected structures.

The orderly and disciplined manner in which the buildings were evacuated is a credit to the teaching staff of the school. When the alarm sounded, students were awakened, bundled in blankets and clothing and assembled in small groups in their sleeping quarters, each group under the supervision of a Sister. When it became apparent to the fire chief that the fire could not be confined to the area of origin, all students were led quickly and with a minimum of confusion into the 21 degrees below zero night. Within eight minutes of the order for evacuation, the staff had completed a roll call of the 400 students and Sisters and was able to report that every occupant was safely outside.



Fire Record of Cities, 1950

The following tables summarize the fire experience for 1950 in cities with population over 20,000 in the United States and Canada. Of the 694 cities canvassed, 636 reported.

These statistics have been collected and published in the April QUARTERLIES since 1943 and represent a permanent reference for members who desire to determine fire experience trends within a particular city by comparing present with past experience. It is not intended that these tables be the basis of comparisons among different cities, as comparisons based on these statistics may be misleading.

The recently published 1950 census figures showed an increase of 119 cities and towns with 20,000 or more population as compared with 1940. These cities have been canvassed and, where available, their 1950 fire experience has been published in the accompanying tables. Per capita data for 1950 based on 1950 census figures is more accurate than the per capita data reported for previous years based on 1940 census figures. This point should be kept in mind when comparing 1950 experience of a particular city with its experience of past years.

Fire departments of 551 United States cities and 46 Canadian cities of over 20,000 population have reported their estimates of fire loss, fire alarms, building fires, and false alarms for 1950 to the NFPA Department of Fire Record.

A total of 576 United States cities having more than 20,000 population reported a fire loss for the year 1950 of $213,211,579, amounting to an average loss per person of $3.79 for the 56,353,162 inhabitants of this group. This figure is 22 per cent more than the $3.11 average loss for 1949.

Fifty-five Canadian cities having a total population of 4,807,743 reported a total loss of $21,663,525 for 1950. This was a per capita loss of $4.50, a seven per cent increase from the $4.20 per capita loss in Canadian cities in 1949.

A total of 488 U. S. cities reported both loss data and the number of building fires. The average loss per building fire in these cities for 1950 was $580, compared with $674 in 1949. The average loss per building fire for 43 Canadian cities was $984 in 1950, compared with $744 in 1949.

The total number of building fires reported by 567 U. S. cities was 236,380, an average of 4.15 fires per 1,000 population, as compared with 4.20 building fires per 1,000 population in 1949, and 4.43 in 1948. Forty-nine Canadian cities reported 19,768 building fires in 1950. The number per 1,000 population was 4.30 in 1950 as compared with 5.53 in 1949.

Automobile fires (including trucks) reported by 550 U. S. cities totaled 72,590, an average of 1.28 fires per 1,000 population. Forty-nine Canadian cities reported 2,685 automobile fires, an average of 0.64 per 1,000 population.

Fire departments in 572 U. S. cities of more than 20,000 population answered 738,884 alarms in 1950. The number of alarms answered in 54 Canadian cities was 53,174.

In the United States, 556 cities of over 20,000 reported 51,855 false alarms in 1950. This was 7.0 per cent of the total calls answered. It will be noted that these are "malicious false alarms" and not just cases where smoke or steam, etc., was honestly mistaken for fire. Forty-nine Canadian cities reported 6,321 malicious false alarms, or 11.9 per cent of their total calls.

Fire departments have been very co-operative in furnishing fire loss figures. Most of the 58 nonreporting cities did not record their fire experience. In a number of cases loss figures reported are preliminary estimates and may be subject to upward revision when end-of-year fire losses are adjusted.

While there are occasional discrepancies in the manner in which certain cities report losses, our questionnaire calls for the total fire loss, both insured and uninsured, and this is the figure given unless otherwise indicated. Chimney and roof fires have been included in the number of building fires. A few cities do not give a complete record, but on the whole it is believed that these figures present a reliable indication of the relative trends in city fire losses in the United States and Canada.

1950 FIRE LOSSES, CITIES OF 20,000 POPULATION AND OVER

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
ALABAMA							
Anniston	31,150	.....	...	...	...	...	...
Bessemer	28,471	$41,145c	206	81	23	1	2.8
Birmingham	298,720	872,068	3,866	1,221	411	368	4.1
Dothan City	21,556	116,208	409	181	47	6	8.4
Florence	23,832	.....	...	...	...	...	...
Gadsden	55,528	80,997	690	194	54	33	3.5
Mobile	127,151	291,289	1,156	584	126	75	4.6
Montgomery	195,098	140,838	1,078	449	115	82	2.3
Phenix City	23,285	8,250	192	77	26	3	3.3
Selma	22,629	27,171	196	117	28	3	5.2
Tuscaloosa	46,364	.....	...	...	...	...	...
ARIZONA							
Phœnix	105,042	618,509c	1,113	399	162	84	3.8
Tucson	45,064	41,937	840	90	59	101	2.0
ARKANSAS							
El Dorado	23,047	60,860	317	95	42	8	4.1
Fort Smith	47,864	80,917	1,097	230	77	39	4.8
Hot Springs	29,298	80,997	356	...	55	17	...
Little Rock	101,387	302,410c	2,002	607	155	0	6.0
North Little Rock	42,142	105,585	1,054	215	117	15	5.1
Pine Bluff	37,147	54,139b	583	263	60	7	7.1
CALIFORNIA							
Alameda	63,425	55,862	780	182	59	68	2.9
Alhambra	51,284	.....	...	...	...	...	...
Arcadia	23,041	.....	...	...	...	...	...
Bakersfield	34,540	129,961c	747	129	111	92	3.7
Berkeley	113,217	117,435	1,605	422	154	50	3.7
Beverly Hills	30,000	155,575	361	117	20	22	3.9
Burbank	78,318	539,041	859	218	118	3	2.8
Compton	47,893	117,429	488	109	59	6	2.2
Eureka	22,913	46,000	290	73	64	4	3.2
Fresno	90,618	453,072	710	200	116	91	2.2
Glendale	95,398	281,380	964	250	129	61	2.6
Huntington Park	29,376	288,223	212	70	44	15	2.4
Inglewood	46,046	59,042	358	102	89	4	2.2
Long Beach	244,072	308,697	1,816	324	156	81	1.3
Los Angeles	1,957,692	2,655,331	23,111	6,513	2,483	1,572	3.3
Lynwood	25,534	12,698	243	59	33	18	2.3
Monrovia	20,274	7,848	388	42	29	6	2.1
Montebello	21,754	9,090	241	63	27	4	2.9
Monterey Park	20,113	10,626	143	43	26	10	2.0
National City	21,132	36,580	217	41	34	1	1.9
Oakland	380,576	1,215,429	4,662	1,404	471	551	3.7
Ontario	22,823	35,766	220	54	41	2	2.4
Oxnard	21,159	22,659	131	62	26	2	2.9
Palo Alto	25,290	116,023	373	107	39	33	4.2
Pasadena	104,085	656,795	1,154	361	195	61	3.5
Pomona	35,157	28,243a	609	94	55	10	2.7
Redondo Beach	25,208	62,348	295	49	45	2	1.9
Redwood	25,342	32,576	470	75	37	26	3.0
Richmond	99,218	134,999c	804	369	89	59	3.7
Riverside	46,399	149,167	497	150	171	23	3.2

a. Estimated. b. Insured loss. c. Building and contents.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
CALIFORNIA (Continued)							
Sacramento	135,761	327,576	1,621	423	187	122	3.1
San Bernardino	62,792	208,649a	785	170	89	36	2.7
San Diego	321,485	414,710	3,110	991	329	108	3.1
San Francisco	760,753	.....	...	...	...	...	...
San Gabriel	20,204	33,548	144	40	22	6	2.0
San Jose	95,044	126,019	909	191	...	41	2.0
San Leandro	27,498	35,299	314	75	38	14	2.7
San Mateo	41,536	58,080	509	190	44	12	4.6
Santa Ana	45,534	160,257	542	137	62	14	3.0
Santa Barbara	44,764	75,724	562	145	53	45	3.2
Santa Cruz	21,848	81,003	355	71	33	15	3.2
Santa Monica	71,299	99,001	995	267	94	77	3.7
South Gate	50,684	259,504	712	168	71	14	3.3
Stockton	71,660	323,511	1,294	312	164	52	4.4
Torrance	22,206	33,118	361	101	40	11	4.6
Vallejo	23,164	.....	...	...	...	...	...
Whittier	23,866	51,904	257	43	29	9	1.8
COLORADO							
Colorado Springs	45,268	419,281	561	278	57	25	6.1
Denver	412,856	750,000	3,704	1,683	457	425	4.1
Greeley	21,000	56,679	256	93	52	12	4.4
Pueblo	63,561	39,843	2,905	366	159	31	5.8
CONNECTICUT							
Bridgeport	159,352	212,759	1,443	584	252	61	3.7
Bristol	35,893	60,255	392	128	49	18	3.6
Danbury	22,424	66,719	389	38	4	11	1.7
East Hartford	29,340	47,859c	377	69	56	9	2.4
Fairfield	30,370	46,585	670	62	42	2	2.0
Greenwich	40,546	244,845	872	155	55	7	3.8
Hamden	29,311	58,079	509	41	50	17	1.4
Hartford	177,073	164,582	2,161	694	304	164	3.9
Manchester	33,906	.....	...	...	...	...	...
Meriden	43,747	78,235	455	167	60	11	3.8
Middletown	29,665	.....	...	...	...	...	...
Milford	26,345	.....	...	...	...	...	...
New Britain	73,663	29,822	743	187	81	20	2.5
New Haven	163,344	367,711c	2,617	767	225	166	4.7
New London	30,367	25,465	598	157	52	21	5.2
Norwalk	49,458	523,113	805	218	98	29	4.4
Norwich	23,382	107,132	317	149	35	8	6.4
Stamford	73,584	145,849	706	134	89	45	1.8
Stratford	23,620	51,375	469	57	38	17	2.4
Torrington	27,770	22,748	254	88	30	9	3.2
Waterbury	104,242	340,476	1,390	435	147	54	4.2
West Hartford	44,401	29,578	406	141	41	5	3.2
West Haven Twp.	31,876	41,351	413	15	13	19	0.5
DELAWARE							
Wilmington	109,907	617,245	1,324	755	164	56	6.9
DISTRICT OF COLUMBIA							
Washington, D. C.	797,670	1,573,335	9,853	3,030	839	1,189	3.8
FLORIDA							
Daytona Beach	29,254	105,488	452	137	30	11	4.7
Fort Lauderdale	40,000	61,887	489	101	53	...	2.5
Gainesville	26,577	37,000a	254	78	36	8	2.9

a. Estimated. c. Building and contents.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
FLORIDA (Continued)							
Jacksonville	198,800	1,069,744	3,027	741	160	107	3.7
Key West	21,724	133,975	230	20	12	5	0.9
Lakeland	30,846	2,875	481	170	47	16	5.5
Miami	246,983	582,632	3,801	572	204	209	2.3
Miami Beach	45,541	63,000a	552	155	90	23	3.4
Orlando	51,826	23,329	576	36	35	37	0.7
Panama	26,248	74,270	448	161	35	6	6.1
Pensacola	43,293	98,252	552	214	33	33	5.0
St. Petersburg	95,712	62,680a, c	1,469	165	99	5	1.7
Tallahassee	27,158	28,485	551	65	47	4	2.4
Tampa	124,073	340,401	1,430	379	143	186	3.1
West Palm Beach	43,053	121,462	324	57	26	10	1.3
GEORGIA							
Albany	30,987	33,893	346	286	26	34	9.3
Athens	20,102	9,480	361	15	55	14	0.7
Atlanta	327,090	686,827	5,544	288	535	208	0.9
Augusta	71,507	491,312	976	555	169	54	7.8
Columbus	79,510	112,365	748	363	130	51	4.6
Decatur	21,626	26,874c	182	65	16	14	3.0
East Point	21,628	62,137	418	334	45	29	15.5
La Grange	24,954	46,754	459	64	46	12	2.6
Macon	70,106	137,086	633	395	89	28	5.6
Marietta	20,628	44,078	292	109	35	1	5.3
Rome	29,617	74,643	463	...	...	12	...
Savannah	119,689	177,691	1,562	822	153	89	6.9
Valdosta	20,004	.....	...	...	...	...	...
IDAHO							
Boise	34,152	525,537c	489	111	16	20	3.3
Pocatello	25,882	235,640	304	258	11	22	9.9
ILLINOIS							
Alton	32,176	127,740	370	193	58	4	6.0
Aurora	50,508	276,900	612	197	72	8	3.9
Belleville	32,701	35,476	332	85	50	2	2.6
Berwyn	51,176	52,810	494	139	42	6	2.7
Bloomington	34,048	37,735c	500	159	71	65	4.7
Champaign	39,397	200,000	325	...	...	...	...
Chicago	3,606,436	.....	...	...	...	...	...
Chicago Heights	24,369	476,868	175	100	19	11	4.1
Cicero	67,197	53,705	866	209	86	57	3.1
Danville	37,892	71,768	466	265	82	8	7.0
Decatur	67,803	607,131	595	345	115	19	5.1
East St. Louis	81,950	172,282	1,091	555	129	90	6.8
Elgin	42,003	64,265a	400	98	56	12	2.3
Elmhurst	21,204	11,700	126	36	24	12	1.7
Evanston	73,030	190,789	1,009	312	71	61	4.3
Freeport	22,425	39,740	338	287	3	13	12.8
Galesburg	31,357	35,990	263	72	42	4	2.3
Granite City	29,139	.....	...	...	...	...	...
Harvey	20,636	20,993	314	120	53	17	5.8
Jacksonville	20,374	21,713	237	187	40	1	9.2
Joliet	52,460	376,840c	864	190	60	24	3.6
Kankakee	25,873	157,230	674	86	29	15	3.3
Maywood	27,409	25,225	305	161	24	8	5.9
Moline	37,296	56,196	402	129	68	53	3.5
Oak Park	63,175	60,015	1,136	246	72	6	3.9

a. Estimated. c. Building and contents.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
ILLINOIS (Continued)							
Pekia	21,912	60,411	194	110	49	2	5.0
Peoria	111,523	78,767	1,375	740	195	89	6.6
Quincy	41,402	291,170	703	297	78	33	7.2
Rockford	92,503	118,302	1,142	444	161	13	4.8
Rock Island	48,594	56,247	494	222	106	43	4.6
Springfield	80,832	755,932	1,870	835	70	60	1.0
Urbana	22,995	34,275	209	84	31	0	3.7
Waukegan	39,099	33,905	733	211	89	20	5.4
INDIANA							
Anderson	46,809	154,827	572	170	99	39	3.6
Bloomington	28,191	18,790	439	147	74	10	5.2
East Chicago	54,124	75,425	931	83	91	72	1.5
Elkhart	35,556	473,755	757	353	...	18	9.9
Evansville	109,869	258,905	1,569	710	176	139	6.5
Fort Wayne	132,840	128,091	2,433	1,876	207	210	14.1
Gary	132,496	.....	...	...	...	...	...
Hammond	87,423	250,733	1,219	377	133	44	4.3
Indianapolis	424,683	1,357,941a	4,295	2,047	679	314	4.8
Kokomo	38,600	3,066	404	193	66	28	5.0
Lafayette	35,508	40,097	487	208	110	18	5.9
Logansport	20,933	13,020	440	271	58	24	13.0
Marion	30,059	125,430	409	260	60	16	8.7
Michigan City	28,379	55,035	355	220	44	9	7.8
Mishawaka	32,878	103,032	405	103	42	31	3.1
Muncie	58,364	332,758	846	455	71	52	7.8
New Albany	29,297	120,000	510	400	50	24	13.7
Richmond	39,504	32,815c	...	540	70	...	1.3
South Bend	115,698	254,319	1,525	656	179	202	5.7
Terre Haute	64,047	171,000	1,305	448	146	21	7.0
IOWA							
Ames	23,105	12,393c	230	230	...	...	10.0
Burlington	30,639	232,506	547	170	59	2	5.6
Cedar Rapids	72,149	157,932	872	445	100	31	6.2
Clinton	30,151	47,454	691	185	129	7	6.1
Council Bluffs	45,184	350,198	621	203	64	27	4.5
Davenport	73,640	249,388	987	418	142	63	5.7
Des Moines	176,954	1,037,859	2,901	774	325	122	4.4
Dubuque	49,528	35,598	911	362	81	22	7.3
Fort Dodge	25,025	40,346	273	117	56	7	4.7
Iowa City	27,018	40,280	388	109	45	3	4.0
Mason City	27,593	126,071a	452	116	42	1	4.2
Ottumwa	33,640	104,424	596	342	37	2	10.2
Sioux City	34,035	294,828	1,253	478	168	64	14.0
Waterloo	64,354	220,967	1,004	353	133	93	5.5
KANSAS							
Hutchinson	33,524	170,121	527	155	67	21	4.6
Kansas City	129,583	362,843	2,365	687	357	111	5.3
Lawrence	23,292	.....	...	...	...	...	...
Leavenworth	20,543	49,021	383	126	32	1	6.6
Salina	26,141	54,335	229	174	42	13	6.6
Topeka	77,827	167,034	963	272	137	78	3.5
Wichita	166,306	284,970	2,650	588	282	44	3.5
KENTUCKY							
Ashland	31,228	272,696	534	198	97	30	6.3
Covington	64,282	274,426	534	193	97	30	3.0

a. Estimated. c. Building and contents.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
KENTUCKY (Continued)							
Lexington	54,449	89,258	995	269	99	148	4.9
Louisville	367,359	312,669	3,595	2,022	503	159	5.5
Newport	31,015	6,400	271	157	46	10	5.1
Owensboro	33,983	204,305	580	248	73	21	7.3
Paducah	32,430	226,336	472	315	53	8	9.7
LOUISIANA							
Alexandria	34,685	53,385	421	165	84	31	4.7
Baton Rouge	123,957	.....	...	...	...	...	...
Lafayette	33,465	106,696	323	131	51	4	3.9
Lake Charles	41,202	54,650	526	73	42	51	1.8
Monroe	38,375	179,126	795	232	79	38	6.1
New Orleans	567,257	1,332,495	4,579	1,968	242	209	3.5
Shreveport	125,506	352,510	1,423	415	162	80	3.3
MAINE							
Auburn	23,078	.....	395	84	33	5	4.0
Augusta	20,900	71,689d	354	236	30	2	11.3
Bangor	31,473	410,066	711	375	65	78	11.9
Biddeford	20,700	75,846	397	163	29	7	7.9
Lewiston	41,142	173,421	822	398	27	8	9.6
Portland	76,936	87,824	1,695	144	87	108	1.9
South Portland	21,732	16,321	464	132	41	17	6.1
MARYLAND							
Baltimore	940,205	2,754,029	11,735	5,157	1,224	684	5.5
Cumberland	37,632	.....	463	204	82	29	5.4
Hagerstown	36,232	.....	...	...	...	...	...
MASSACHUSETTS							
Arlington	43,984	95,560c	932	447	66	43	10.2
Attleboro	23,665	38,332b	575	145	54	4	6.1
Belmont	27,379	64,520c	555	161	42	24	5.9
Beverly	28,855	.....	959	243	57	11	8.4
Boston	790,863	.....	16,065	4,128	1,161	2,146	5.2
Braintree	23,130	49,508	671	118	50	19	5.1
Brockton	62,856	88,618	1,378	425	115	48	6.8
Brookline	56,952	.....	...	...	...	...	...
Cambridge	120,676	145,861	2,484	539	127	390	4.5
Chelsea	39,038	217,905	1,359	367	98	107	9.4
Chicopee	48,939	135,167	730	207	49	24	4.2
Everett	45,789	100,949c	935	250	100	61	5.5
Fall River	111,759	86,479c	1,277	417	118	86	3.7
Fitchburg	42,671	83,996c	925	230	68	23	5.4
Framingham	27,845	43,219b	720	189	69	45	6.8
Gloucester	25,048	121,131	767	192	40	33	7.7
Haverhill	47,213	183,660	1,376	341	178	106	7.2
Holyoke	54,441	68,993	1,159	475	80	57	8.7
Lawrence	80,427	300,000a	1,710	298	144	56	3.7
Leominster	24,084	96,021c	485	36	23	6	1.5
Lowell	96,523	176,409c	1,850	555	161	64	5.8
Lynn	99,521	.....	2,581	899	181	174	8.9
Malden	59,779	190,000	1,298	88	74	43	1.5
Medford	66,109	149,634	1,367	...	...	97	..
Melrose	26,919	19,234	409	25	18	12	9.3
Methuen	24,411	97,828	616	176	44	11	7.2
Milton	22,395	33,705c	660	87	45	64	3.7
New Bedford	109,033	154,634	1,280	409	106	49	3.7

a. Estimated. b. Insured loss. c. Building and contents. d. Incomplete.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
MASSACHUSETTS (Continued)							
Newton	80,996	374,509	1,612	148	114	57	1.8
North Adams	21,475	51,084b,c	388	...	...	...	...
Northampton	28,998	40,865	419	192	39	24	6.6
Peabody	22,647	84,437a	680	146	...	10	6.5
Pittsfield	53,055	77,118b	811	244	105	28	4.6
Quincy	83,190	390,503	2,191	367	113	142	4.4
Revere	36,663	140,154	1,323	137	65	132	3.7
Salem	41,842	327,466	1,085	276	125	23	6.6
Somerville	102,254	268,167	2,009	513	196	221	5.0
Springfield	162,601	579,505	2,866	561	202	355	3.5
Taunton	40,056	500,887	763	408	37	47	10.2
Waltham	47,198	91,513	1,082	216	50	80	4.6
Watertown	37,339	49,085	790	173	31	48	4.6
Wellesley	20,847	9,629d	557	21	48	24	1.0
Westfield	20,961	42,182	397	130	29	6	6.2
West Springfield	20,398	87,472	378	78	35	30	3.8
Weymouth	32,695	49,099	776	146	49	23	4.5
Woburn	20,269	240,670	847	96	49	70	4.8
Worcester	201,885	745,540	4,643	2,170	264	553	10.8
MICHIGAN							
Ann Arbor	47,279	851,466	509	52	33	11	1.1
Battle Creek	48,469	311,743	903	228	88	66	4.7
Bay City	52,372	241,370	905	430	41	28	8.2
Dearborn	94,529	294,483	1,179	290	139	102	3.1
Detroit	1,838,517	4,724,246a	17,291	5,970	2,330	1,782	3.3
East Detroit	21,373	19,165	226	72	47	3	3.4
East Lansing	20,310	155,009	162	32	23	1	1.6
Ferndale	29,670	24,132	384	196	41	12	6.6
Flint	162,800	312,925	2,092	...	225	289	...
Grand Rapids	175,647	346,650	1,583	320	147	94	1.8
Hamtramck	43,245	748,378	700	466	58	68	10.8
Highland Park	46,155	66,035	733	179	89	28	3.9
Jackson	50,904	47,041	737	264	99	41	5.2
Kalamazoo	51,326	137,890	726	363	96	32	7.1
Lansing	91,694	145,050	2,066	360	219	81	3.9
Lincoln Park	29,265	43,906	391	99	65	58	3.4
Monroe	21,275	31,246	319	161	38	28	7.6
Muskegon	48,047	230,529	482	283	48	...	5.9
Pontiac	73,112	232,792	1,136	338	114	96	4.6
Port Huron	35,297	80,893	575	163	72	25	4.6
River Rouge	20,366	23,383	212	120	25	25	5.9
Royal Oak	46,817	.....	...	...	...	...	...
Saginaw	92,352	220,897c	1,201	307	124	44	3.3
Wyandotte	36,666	42,424	524	143	49	60	3.9
MINNESOTA							
Austin	23,035	79,814	181	105	23	5	4.6
Duluth	104,066	211,075	1,373	938	95	59	9.0
Minneapolis	517,277	2,475,088	5,050	1,137	546	256	2.2
Rochester	29,634	50,000a	367	119	31	76	4.0
St. Cloud	22,744	56,034	318	268	19	8	11.8
St. Louis Park	22,495	68,080	354	118	37	1	5.2
St. Paul	309,474	1,755,000a	3,921	728	455	248	2.4
Winona	24,965	18,229	313	112	34	28	4.5
MISSISSIPPI							
Biloxi	37,034	44,295c	320	102	42	1	2.8
Greenville	29,914	29,436	362	202	51	7	6.8
Gulfport	22,428	.....	...	...	...	...	...

a. Estimated. b. Insured loss. c. Building and contents. d. Incomplete.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
MISSISSIPPI (Continued)							
Hattiesburg	29,432	41,975	492	165	58	9	5.6
Jackson	97,674	131,430	1,027	419	115	52	4.3
Laurel	24,988	77,862	303	121	34	4	4.9
Meridian	41,709	144,053	602	257	66	34	6.2
Natchez	22,678	.....	...	...	...	...	...
Vicksburg	27,344	66,800	450	66	39	18	2.4
MISSOURI							
Cape Giradeau	21,539	.....	...	...	...	...	...
Columbia	31,731	28,043c	452	175	45	8	5.5
Hannibal	20,486	113,082	324	101	51	3	4.9
Independence	36,832	86,065	593	169	69	30	4.6
Jefferson City	24,990	87,582c	450	95	36	5	3.8
Joplin	37,188	72,810	977	342	138	24	9.2
Kansas City	439,646	1,743,920	6,725	2,049	786	395	4.7
St. Joseph	75,572	184,054	1,575	465	217	56	6.2
St. Louis	852,623	1,752,519	8,988	4,067	1,133	1,057	4.8
Sedalia	20,269	46,901	394	...	42	...	...
Springfield	66,302	206,787	1,248	421	158	40	6.4
University City	39,595	147,358	811	100	36	14	2.5
Webster Grove	23,289	17,205	187	62	19	...	2.7
MONTANA							
Billings	31,725	208,450	365	125	20	33	3.9
Butte	32,904	270,665	413	201	30	145	6.1
Great Falls	39,006	78,670	408	21	26	31	0.5
Missoula	22,320	348,181	307	281	16	10	12.6
NEBRASKA							
Grand Island	22,835	9,803	1,131	266	46	24	11.6
Hastings	20,108	66,968	322	101	42	1	5.0
Lincoln	97,423	77,111c	1,220	429	213	14	4.4
Omaha	247,408	897,781	2,942	1,079	414	77	4.4
NEVADA							
Las Vegas	24,418	44,499	542	197	87	38	8.1
Reno	32,225	223,436	1,021	361	60	13	11.2
NEW HAMPSHIRE							
Concord	27,984	110,163	762	33	58	8	1.2
Manchester	82,581	220,988	1,370	418	133	28	5.1
Nashua	34,666	162,140	648	569	...	14	16.4
NEW JERSEY							
Atlantic City	61,642	346,913	727	470	86	171	7.6
Bayonne	76,657	.....	922	440	96	95	5.8
Belleville	32,059	35,828	492	127	51	16	4.0
Bloomfield	49,313	37,878	654	197	47	16	4.0
Camden	125,546	319,897	1,593	353	133	117	2.8
Clifton	64,567	118,328	781	105	84	28	1.6
East Orange	78,057	78,259	767	236	90	37	3.0
Elizabeth	112,675	177,496c	1,018	378	132	76	3.4
Englewood	23,092	.....	...	...	...	...	...
Fair Lawn	23,865	.....	...	...	...	...	...
Garfield	27,605	26,675	140	46	28	4	1.7
Hackensack	29,207	60,933	581	112	53	10	3.8
Hillside	21,000	21,755	432	115	40	...	5.5
Hoboken	50,510	92,603	795	304	64	40	6.0
Irvington	59,142	331,176	2,129	237	79	19	4.0

c. Building and contents. d. Incomplete.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
NEW JERSEY (Continued)							
Jersey City	300,447	419,290	3,174	1,612	407	340	5.4
Kearny	39,828	25,000	472	102	78	32	2.6
Linden	30,434	78,713	656	...	51	22	...
Long Branch	23,094	.....	...	...	...	...	...
Maplewood	25,000	25,699d	257	109	31	16	4.4
Montclair	43,775	79,656	607	219	87	24	5.0
Newark	437,857	2,280,150	5,234	2,289	806	440	5.2
New Brunswick	38,768	336,124	619	196	70	33	5.1
North Bergen Twp.	39,714*	41,050	984	456	70	27	11.5
Nutley	26,746	40,661	476	78	27	27	2.9
Orange	38,413	32,383	386	143	39	38	3.7
Passaic	57,851	303,909	746	276	80	51	4.8
Paterson	139,423	292,648	1,618	854	285	86	6.1
Perth Amboy	41,291	35,000	286	120	44	12	2.9
Plainfield	42,212	125,751c	675	194	15	33	4.6
Rahway	21,287	.....	...	...	...	...	...
Teaneck Twp.	34,000	56,458	843	105	30	10	3.1
Trenton	127,867	154,033	1,390	576	202	103	4.5
Union City	55,322	8,447	135	39	39	9	0.7
Union Twp.	39,000	213,889	579	92	50	2	2.4
West New York	37,754	34,674	735	118	53	47	3.1
Westfield	21,335	.....	360	103	29	8	4.8
West Orange	28,624	117,908a	341	85	48	19	3.0
NEW MEXICO							
Albuquerque	97,000	.....	...	...	...	...	...
Roswell	25,572	41,796	354	310	44	...	12.1
Santa Fe	29,750	46,510	215	67	52	4	2.3
NEW YORK							
Albany	134,382	306,509c	2,129	728	187	232	5.4
Amsterdam	32,269	67,102	269	125	30	11	3.9
Auburn	36,667	79,982	404	167	49	35	4.6
Binghamton	81,132	98,414	686	196	46	18	2.4
Buffalo	577,393	1,272,095	6,778	1,214	495	251	2.1
Cohoes	21,235	19,811c	322	81	...	7	3.8
Elmira	49,690	49,982	722	444	58	9	9.0
Endicott	20,168	58,403	182	60	17	7	3.0
Freeport	24,589	.....	...	...	...	...	...
Gloversville	23,576	84,539	333	64	34	10	2.7
Hempstead	29,021	116,994	389	106	51	16	3.7
Irondiquoit Twp.	34,045	.....	...	...	...	...	...
Ithaca	29,395	65,022	215	118	47	7	4.0
Jamestown	43,250	372,499	...	...	...	...	...
Kenmore	20,332	38,738	107	25	21	5	1.2
Kingston	28,860	54,237	514	192	58	31	6.7
Lackawanna	27,646	34,180	309	60	59	49	2.2
Lockport	25,136	194,710	444	127	51	13	5.1
Middletown	22,565	22,195	215	113	33	4	5.0
Mount Vernon	71,837	408,909	827	181	33	4	2.5
Newburgh	31,924	135,039c	273	138	46	8	4.3
New Rochelle	59,626	91,103	612	224	64	21	3.8
New York	7,835,099	19,512,370c	62,021	21,301	6,628	10,764	2.7
Niagara Falls	90,875	265,489	913	246	90	83	2.7
North Tonawanda	24,730	47,660	265	95	25	6	3.9
Olean	22,842	20,655	162	24	26	15	1.0
Oswego	22,611	.....	...	...	...	...	...

a. Estimated. b. Insured loss only. c. Building and contents. * 1940 census.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
NEW YORK (Continued)							
Port Chester	23,969	.....	...	...	...	...	...
Poughkeepsie	40,975	.....	...	...	...	...	...
Rochester	331,252	450,683	3,199	803	258	121	2.4
Rockville	22,274	642,019	163	53	20	7	2.4
Rome	41,379	41,079b,c	497	123	57	6	3.0
Schenectady	92,070	.....	...	...	...	...	...
Syracuse	220,067	479,448	1,800	675	285	182	3.1
Troy	71,659	272,867c	767	307	214	14	4.3
Utica	101,479	418,270	930	272	115	42	2.7
Valley Stream	26,833	11,000	103	34	17	13	1.3
Watertown	34,280	115,445	440	132	50	21	3.9
White Plains	43,501	85,150	519	158	67	37	3.6
Yonkers	152,533	504,971a	2,228	613	148	105	4.0
NORTH CAROLINA							
Asheville	52,208	77,772	872	309	112	68	5.9
Burlington	24,495	91,628	...	...	...	...	...
Charlotte	133,219	339,272c	2,240	1,071	329	205	8.1
Durham	70,307	129,075c	979	454	129	50	6.5
Fayetteville	34,605	85,670	892	318	101	45	9.2
Gastonia	23,003	241,955	320	111	40	23	4.8
Goldsboro	21,399	28,709	376	207	37	20	9.7
Greensboro	73,703	210,571	1,196	272	137	103	3.7
High Point	39,930	250,011	599	231	70	44	5.9
Raleigh	65,123	234,309	912	523	64	83	8.0
Rocky Mount	27,644	50,516	431	172	49	13	6.2
Wilmington	44,925	114,521	671	397	50	88	8.8
Wilson	22,964	15,989	322	171	42	20	7.5
Winston-Salem	86,816	377,548	1,122	166	...	67	1.9
NORTH DAKOTA							
Fargo	37,981	158,656	621	...	...	...	...
Grand Forks	26,617	13,864	340	245	16	16	9.2
Minot	21,924	283,866	221	90	18	4	4.1
OHIO							
Akron	273,189	820,818	2,168	585	286	222	2.1
Alliance	26,112	102,168	104	70	28	4	2.7
Ashtabula	23,093	120,303	326	110	28	4	4.8
Barberton	27,893	27,012	303	72	49	29	2.6
Canton	116,312	.....	...	...	...	...	...
Chillicothe	20,121	92,365	224	46	59	17	2.3
Cincinnati	500,510	1,360,593	4,983	1,836	712	301	3.7
Cleveland	905,636	.....	...	...	...	...	...
Cleveland Heights	58,782	82,480	874	203	53	11	3.5
Columbus	374,770	316,352	12,417	2,231	696	133	6.0
Cuyahoga Falls	29,076	50,131	333	64	35	26	2.2
Dayton	243,108	666,082	2,879	627	324	233	2.6
East Cleveland	39,875	18,720	301	128	28	22	3.2
East Liverpool	24,072	105,600	614	306	71	6	12.7
Elyria	30,197	40,737	201	96	46	2	3.2
Euclid	41,447	136,833	417	118	46	24	2.9
Findlay	23,806	127,700	221	111	36	4	4.7
Garfield Heights	21,606	.....	...	...	...	...	...

a. Estimated. c. Building and contents.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
OHIO (Continued)							
Hamilton	57,717	93,960	1,082	216	115	35	3.8
Lakewood	67,878	49,939	296	78	42	37	1.2
Lancaster	24,140	64,543	...	...	...	...	...
Lima	49,880	117,988	731	300	96	37	6.0
Lorain	50,819	53,240	443	87	40	40	1.7
Mansfield	43,363	104,220	494	273	101	45	6.3
Marion	33,786	630,293	372	99	59	11	2.9
Massillon	29,524	186,510	460	92	34	8	3.1
Middletown	33,634	79,552	436	150	57	26	4.5
Newark	34,178	27,270	492	210	97	5	6.1
Norwood	34,626	46,363	526	145	32	12	4.2
Parma	28,852	26,211	527	53	23	3	1.8
Portsmouth	36,663	60,000a	351	190	78	28	5.2
Sandusky	29,060	197,942	752	248	68	5	8.6
Shaker Heights	27,980	45,741	343	138	39	15	4.9
Springfield	78,029	208,391c	1,715	443	134	46	5.7
Steubenville	35,695	57,874	414	138	57	43	3.9
Toledo	301,358	1,003,841	2,595	914	415	318	3.0
Warren	49,674	232,484	525	108	64	31	2.2
Youngstown	167,643	224,907	1,160	411	152	74	2.5
Zanesville	40,424	703,150	322	148	85	89	3.7
OKLAHOMA							
Enid	35,976	466,204c	570	167	...	37	4.6
Lawton	34,527	.....	...	...	...	...	...
Muskogee	37,255	144,756	1,045	278	107	25	7.5
Norman	26,972	38,881	440	155	38	0	5.8
Oklahoma City	242,450	548,611	4,730	1,197	439	134	4.9
Ponca	20,185	36,382	543	115	47	10	5.7
Shawnee	24,457	.....	...	...	...	...	...
Stillwater	20,155	43,066	395	130	39	1	6.5
Tulsa	180,586	240,478	3,240	721	206	142	4.0
OREGON							
Eugene	35,672	109,733	816	240	165	22	6.8
Portland	371,011	1,340,575	5,000	3,201	345	296	8.6
Salem	43,064	74,114	576	337	62	6	7.8
PENNSYLVANIA							
Aliquippa	26,067	23,285c	168	89	33	11	3.4
Allentown	106,233	406,961	527	256	7	21	2.4
Altoona	76,844	.....	...	...	...	...	...
Bethlehem	66,027	13,480	314	59	40	0	0.9
Butler	23,511	27,095	197	100	35	2	4.3
Chester	65,824	127,594c	515	183	56	21	2.8
Dunmore	20,302	16,185c	255	123	21	16	6.1
Easton	34,410	.....	238	118	43	5	3.4
Erie	130,125	94,925	1,181	394	110	62	3.0
Harrisburg	89,091	.....	...	...	...	...	...
Hazleton	35,486	.....	...	...	...	...	...
Johnstown	62,723	.....	792	348	47	73	5.6
Kingston	21,061	8,925	122	36	28	17	1.7
Lancaster	63,601	204,756	289	156	51	17	2.5
Lebanon	28,134	4,120	244	63	14	8	2.2
McKeesport	51,223	49,015	506	258	46	42	5.0
Nanticoke	20,140	40,100c	133	112	9	12	5.6
New Castle	48,563	538,965	633	552	54	27	11.3
New Kensington	25,226	66,657	98	48	9	12	1.9
Norristown	38,143	.....	...	...	...	...	...

a. Estimated. c. Building and contents.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
PENNSYLVANIA (Continued)							
Philadelphia	2,064,794	7,207,848a,c	17,993	5,679	1,796	1,865	2.8
Pittsburgh	673,763	1,037,000a	9,769	3,508	453	957	5.2
Pottstown	22,616	174,811c	265	34	25	9	1.5
Pottsville	23,642	356,417	112	64	13	1	2.7
Reading	109,062	.....	...	...	...	...	...
Scranton	124,305	.....	...	...	...	...	...
Sharon	26,305	.....	...	...	...	...	...
Uniontown	20,423	33,135	243	124	38	7	6.1
Upper Darby Twp.	186,000	160,123	461	365	62	10	2.0
Washington	25,898	97,750	206	123	28	15	4.8
Wilkes-Barre	76,639	79,001	507	180	53	43	2.3
Wilkinsburg	31,281	49,018	236	61	53	31	2.0
Williamsport	44,946	172,402	338	155	81	12	3.5
York	59,704	.....	...	...	...	...	...
RHODE ISLAND							
Central Falls	23,610	59,616	306	109	28	23	4.6
Cranston	55,130	.....	...	...	...	...	...
East Providence	35,791	35,293	736	129	40	44	3.6
Newport	32,090	35,487	200	178	29	7	5.6
Pawtucket	81,180	110,040	1,237	268	127	69	3.3
Providence	274,700	839,670	3,759	1,177	203	477	4.3
Warwick Twp.	43,027	53,488a	969	159	66	32	3.7
Woonsocket	50,186	.....	...	...	...	...	...
SOUTH CAROLINA							
Charleston	68,243	164,320	855	376	64	123	5.5
Columbia	85,949	223,859	1,251	795	177	55	9.3
Greenville	57,932	222,538	896	354	152	56	6.1
Spartanburg	36,674	98,913	622	212	92	78	5.8
SOUTH DAKOTA							
Rapid City	25,179	42,195	544	187	36	11	7.4
Sioux Falls	52,161	285,556	497	148	98	12	2.8
TENNESSEE							
Chattanooga	130,333	244,448	1,905	680	190	96	5.3
Jackson	30,098	47,681	394	210	41	...	7.0
Johnson City	27,778	107,355	502	275	36	3	9.9
Knoxville	124,183	109,659c	2,082	866	210	110	7.0
Memphis	394,012	920,871	5,160	1,680	582	134	4.3
Nashville	173,359	1,187,902	2,639	863	296	142	5.0
TEXAS							
Abilene	47,102	122,000	905	35	93	67	7.5
Amarillo	73,737	567.655	1 299	178	...	56	2.4
Austin	131,964	491,564a	2,293	416	204	19	3.2
Baytown	22,927	16,987a	776	80	15	10	3.5
Beaumont	93,715	107,675	1,393	503	100	60	5.4
Brownsville	36,176	34,366	254	74	22	24	2.0
Brownwood	20,140	81,864	577	396	56	82	19.7
Corpus Christi	108.053	176.394	1.225	283	140	107	2.6
Dallas	432,927	3,280,098c	8,139	948	677	313	2.2
Denton	21,345	77,334c	466	74	39	2	3.5
El Paso	130,000	269,050	1,461	600	192*	131	4.6
Fort Worth	277,047	991,134c	5,924	562	479	323	2.0
Galveston	65,898	166,263c	978	436	123	163	6.6

a. Estimated. c. Building and contents. * Autos, boats, outside machinery, etc.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
TEXAS (Continued)							
Harlingen	23,202	9,640	228	43	39	12	1.9
Houston	594,321	1,722,956a	8,839	1,993	596	756	3.4
Laredo	51,694	136,158	381	111	35	4	2.1
Longview	24,445	110,203	533	133	45	...	5.5
Lubbock	71,390	.....	...	...	...	...	...
Marshall	22,255	103,482c	405	91	53	7	4.1
McAllen	20,005	80,440	150	89	32	3	4.4
Midland	21,756	.....	...	...	...	...	...
Odessa	29,432	184,787c	508	482	...	26	16.4
Orange	21,100	58,258c	457	88	21	18	4.2
Pasadena	22,444	.....	...	...	...	...	...
Paris	21,636	55,633c	793	205	66	2	9.5
Port Arthur	57,377	226,395	680	136	48	78	2.4
San Angelo	51,889	128,194c	1,343	622	66	43	12.0
San Antonio	406,811	847,935	5,133	1,246	338	289	3.1
Sherman	20,013	.....	...	...	...	...	...
Temple	24,970	40,307a	348	89	33	18	3.6
Texarkana	24,657	80,531c	407	125	...	8	5.1
Tyler	38,864	67,000c	819	196	102	17	5.0
University Park	23,823	22,583	189	26	9	3	1.1
Waco	84,300	226,810c	994	370	113	33	4.4
Wichita Falls	67,709	121,841	1,101	151	206	55	2.2
UTAH							
Ogden	56,910	305,445	852	206	95	38	3.6
Provo City	28,901	30,836	236	129	22	12	4.5
Salt Lake City	181,718	350,358	2,324	629	190	83	3.5
VERMONT							
Burlington	33,039	.....	528	194	53	52	5.9
VIRGINIA							
Alexandria	61,604	51,035	652	211	150	6	3.4
Arlington County	134,990	229,229a	2,616	471	178	44	3.5
Charlottesville	25,909	6,085c	298	130	53	9	5.0
Danville	34,537	48,191c	413	191	62	9	5.5
Lynchburg	47,639	128,922	817	...	...	49	...
Newport News	41,571	62,935	699	360	43	68	8.7
Norfolk	188,601	1,224,497	3,205	883	220	391	4.7
Petersburg	34,948	295,535	688	457	66	48	13.1
Portsmouth	71,294	.....	...	...	...	...	...
Richmond	229,906	981,165	3,096	1,920	404	191	8.4
Roanoke	91,089	432,772c	1,228	475	...	75	5.2
WASHINGTON							
Bellingham	33,934	113,055	875	545	25	22	16.1
Bremerton	27,746	64,720	413	277	59	35	10.0
Everett	33,807	52,911	809	484	62	66	14.3
Longview	20,556	24,438	239	126	22	22	6.1
Seattle	462,985	624,543	4,737	1,848	442	265	4.0
Spokane	160,484	1,964,419	2,282	1,102	175	158	6.9
Tacoma	142,975	649,820	5,131	1,983	191	103	13.9
Vancouver	27,977	29,137c	748	145	69	3	5.2
Yakima	38,375	61,334	683	343	66	14	9.0
Walla Walla	24,071	170,975	458	276	31	20	11.5

a. Estimated. c. Building and contents.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
WEST VIRGINIA							
Bluefield	21,341	206,210	288	268	...	20	12.6
Charleston	72,818	451,835	736	391	126	85	5.4
Clarksburg	31,817	26,861	230	...	46	8	...
Fairmont	29,273	14,500	174	97	44	0	3.3
Huntington	86,160	1,287,748	1,157	453	138	124	5.3
Morgantown	25,443	8,445c	141	106	26	9	4.2
Parkersburg	29,510	16,631	266	63	47	14	2.1
Weirton	24,143	25,300	143	39	20	2	1.6
Wheeling	58,447	22,130	817	156	78	31	2.7
WISCONSIN							
Appleton	33,892	72,852	528	325	58	17	9.6
Beloit	29,541	55,468a	532	255	50	16	8.6
Eau Claire	35,862	158,014	614	253	72	34	7.0
Fond du Lac	29,826	555,306	698	538	41	28	18.1
Green Bay	52,443	127,714	814	309	98	47	5.9
Janesville	24,829	46,363	511	221	44	12	8.9
Kenosha	54,360	89,997	903	300	66	23	5.6
La Crosse	47,396	122,976	706	438	54	14	9.3
Madison	95,594	237,872	943	312	118	16	3.3
Manitowoc	27,444	31,342	354	147	22	9	5.4
Milwaukee	632,651	2,042,482	10,701	3,093	773	287	4.9
Oshkosh	40,934	68,486a	547	270	62	17	6.6
Racine	70,749	114,460	1,532	331	67	46	4.7
Sheboygan	42,485	38,193	488	336	37	10	7.9
Superior	35,091	144,892	584	321	41	27	9.2
Waukesha	21,186	.....	...	...	...	...	...
Wausau	30,386	48,668	548	225	33	20	7.4
Wauwatosa	33,300	32,800	474	66	27	8	2.0
West Allis	42,945	44,907	703	146	86	7	3.4
WYOMING							
Casper	33,557	256,752	338	176	20	21	5.2
Cheyenne	31,807	35,830	356	121	32	16	3.8

1950 FIRE LOSSES, CANADIAN CITIES

ALBERTA							
Calgary	100,044*	.....	...	...	...	...	...
Edmonton	148,861	418,671	1,163	445	59	106	3.0
Lethbridge	24,000	47,202	189	57	25	7	2.4
BRITISH COLUMBIA							
Burnbay	65,000	409,203	521	131	29	1	2.0
New Westminster	35,000	141,742	547	104	47	18	3.0
Saanich	25,000	49,502a	286	140	7	...	5.6
Vancouver	311,800*	1,485,091c	4,638	884	...	115	2.8
Victoria	62,500	92,220	1,041	777	42	77	12.4
MANITOBA							
Brandon	22,000	54,984	254	30	2	15	1.4
St. Boniface	26,200	26,195	320	238	10	29	9.1
Winnipeg	229,045*	.....	...	...	...	...	...

a. Estimated. c. Building and contents.

City	Population (Last Census)	Total Loss 1950	No. Alarms 1950	No. Bldg. Fires 1950	No. Auto Fires 1950	No. Malicious False Alarms 1950	Bldg. Fires Per 1000 Population
NEW BRUNSWICK							
Fredericton	20,000	87,451	794	...	16	28	...
Moncton	32,000	353,394	451	82	20	15	2.6
Saint John	83,649	211,759	1,231	70	8	45	0.8
NOVA SCOTIA							
Glace Bay	27,180	33,560c	119	90	4	...	3.3
Halifax	100,976	564,063	1,274	958	35	95	9.6
Sydney	35,000	323,818c	770	193	2	121	5.5
ONTARIO							
Brantford	36,123	45,144	518	178	70	20	4.9
Chatham	22,000	42,679	183	128	5	10	5.8
East York Twp.	59,812	32,965c	304	60	33	8	1.0
Etobicoke	44,137	70,221	290	173	27	12	3.9
Fort William	35,000	402,269	405	43	6	21	1.2
Galt	23,085	14,870	177	140	15	7	6.1
Guelph	25,962	161,125c	603	323	22	...	12.5
Hamilton	196,246	305,265a	1,924	738	213	166	3.8
Kingston	32,501	281,755c	550	323	31	49	9.9
Kitchener	40,823	60,000a	272	124	20	2	3.0
London	92,789	235,794a,c	805	235	...	20	2.5
Niagara Falls	21,737	94,662	192	71	22	9	3.3
North York Twp.	65,000	142,063	508	235	51	25	3.6
Oshawa	29,771	21,954	394	267	37	29	9.0
Ottawa	219,463	825,000	2,280	1,257	187	125	5.7
Peterboro	35,065	105,698	626	...	37	48	...
Port Arthur	31,000	48,046	348	106	18	17	3.4
St. Catharines	37,485	60,920a,c	483	213	67	16	5.7
Sarnia	23,000	106,559	221	...	...	32	...
Sault Ste. Marie	29,662	94,559	376	244	25	26	8.3
Scarboro Twp.	34,981	77,505	409	89	35	48	2.5
Sudbury	41,741*	.....	...	...	...	...	...
Timmins	25,779	48,018	536	96	18	6	3.7
Toronto	695,302	2,500,000d	6,572	4,283	590	827	6.1
Windsor	121,011	300,000a	1,048	497	105	138	4.1
York Twp.	95,669	71,175	611	142	51	37	1.5
QUEBEC							
Chicoutimi	21,337	69,745	291	269	...	22	12.6
Hull	42,194	146,722c	879	...	...	90	...
Jonquiere	24,800	57,316	541	51	8	32	2.1
Lachine	30,000	99,600	125	...	9	33	...
Montreal	983,000*	5,678,765	10,580	2,068	463	2,955	2.1
Outremont	31,800*	80,996c	232	159	12	...	5.0
Quebec	205,115	908,510	2,656	1,225	71	482	6.0
Shawinigan Falls	30,000	21,941c	...	...	...	...	...
Sherbrooke	52,000	467,303	753	85	1	50	1.6
Three Rivers	52,000	152,763	531	401	16	20	7.7
Verdun	78,000	111,678c	779	405	37	104	5.2
Westmount	26,900	56,535	216	140	16	...	5.2
SASKATCHEWAN							
Moose Jaw	25,000	55,394	285	62	11	42	2.5
Regina	68,000	199,491	485	347	26	70	5.1
Saskatoon	46,028*	109,656	588	395	24	51	8.6

a. Estimated. c. Building and contents. d. Incomplete. * 1940 Census.

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Waterflow alarms, caused by fires or serious leaks	3,421
Manual fire alarms	112
Insurable values of properties protected	$9,011,189,000
Ratio of losses to insurable values protected	3/100ths of 1%
Fire loss immunity in 1950	$99\frac{97}{100}\%$
AVERAGE FIRE LOSS IMMUNITY DURING THE PAST TEN YEARS	$99\frac{98}{100}\%$

WATCHMAN'S REPORTING AND MANUAL FIRE ALARM SERVICE

Investigations of failures of watchmen to signal Central Station on schedule	201.951
Total number of signals recorded	339,107,720
Watchmen's patrol efficiency	99 94/100ths %
Alarms from Manual Fire Alarm Boxes	1,261
Insurable values of properties protected	$15,222,951,000
Ratio of losses to insurable values protected	2/100ths of 1%
Fire loss immunity in 1950	$99\frac{98}{100}\%$
AVERAGE FIRE LOSS IMMUNITY DURING THE PAST TEN YEARS	$99\frac{96}{100}\%$

BURGLAR AND HOLDUP ALARM SERVICES

Insurable values of properties protected	$2,654,611,000*

*Not including ADT-protected values in bank vaults, the U.S. Treasury, Federal Reserve Banks and branches, the U.S. Mints and the U.S. Bullion Depositories at Fort Knox, Ky., and West Point, N. Y.

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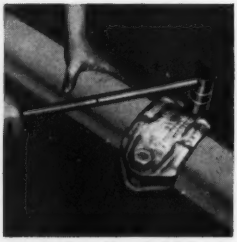

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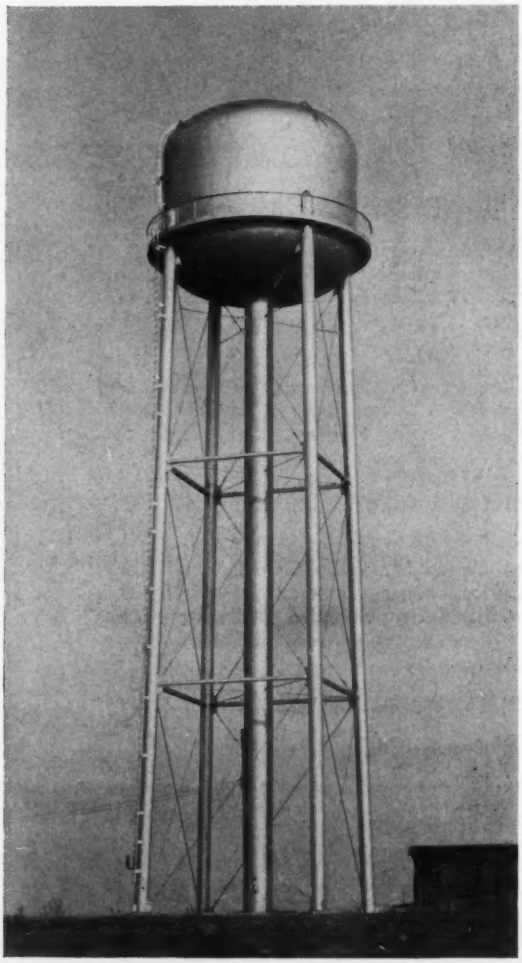

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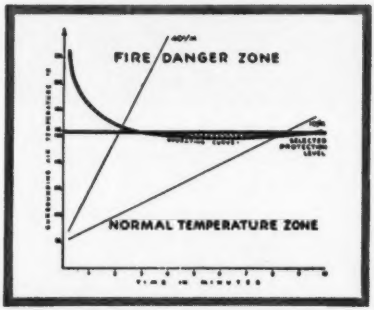

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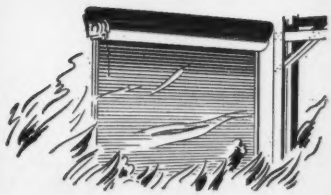

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You get *positive, automatic* fire protection at doorways, windows and other openings with Akbar Fire Doors. They're *pushed* downward by a strong spring . . . *controlled* in downward speed by a special safety device . . . and operable in emergency *after* automatic closure. Coiled out of the way overhead when not in use, they lower quickly into place when fire threatens, cutting off drafts and confining flames to small areas. Approved by Underwriters' Laboratories, they are built in any size. Kinnear Rolling Fire Doors can also be equipped for daily service with motor or manual operation. (Non-labeled Kinnear Rolling Doors are preferred for service use where maximum fire protection is not required.) Write!

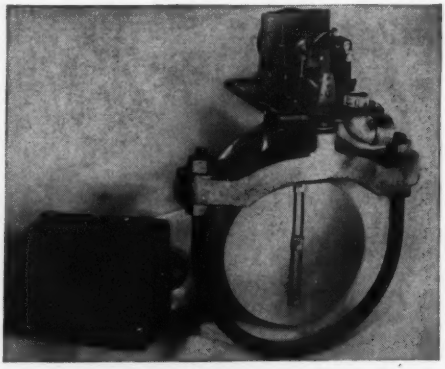
The KINNEAR Manufacturing Co.

Factories: 2250-70 Fields Ave., Columbus 16, Ohio; 1742 Yosemite Ave., San Francisco 24, Cal.

Offices and Agents in All Principal Cities

SAVING WAYS in DOORWAYS

KINNEAR ROLLING DOORS



5-inch size shown above. To install simply drill hole in pipe.

CENTRAL STATION SIGNALS, INC. Model PRS

Waterflow Alarm Device is approved by both the Factory Mutual Laboratories and Underwriters' Laboratories, Inc. In hundreds of installations it has proved to be the ideal alarm device for sprinkler systems.

SAVE VITAL MATERIALS! Install this water flow alarm device in place of bulky alarm valves. Only 10 oz. of vital material used in our water flow switch.

- **Made in all sizes from 2½" to 8"**
- **It is positive in operation**
- **Has instantly recycling pneumatic retarding device which prevents false alarms**
- **Has enclosed electrical contacts for 15 amp, 125 volts AC and ½ amp, 125 volts DC**

By installing this most economical alarm device, you will know instantly where the water is flowing. Many plants are having them installed on each floor or in each section. They save water damage.

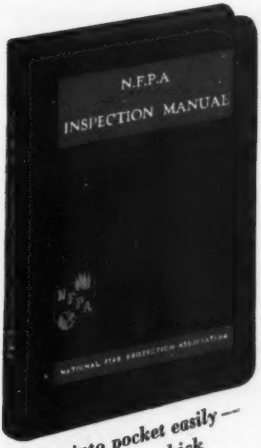
This device can also be obtained as Model PRT, a coded waterflow transmitter from which signals are received on a punch register and single stroke gong. Practically any number can be installed on a two-wire system, thus resulting in considerable savings on wiring.

WE SOLICIT YOUR INQUIRIES

CENTRAL STATION SIGNALS, INC.

Manufacturers of all kinds of approved devices used in Central Station Systems or Class 'A' or Class 'B' Proprietary Fire Alarm Systems, either automatic or manual.

71 WEST 23rd STREET -:- NEW YORK 10, N. Y.



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336 pages

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Property owners, central managements, fire departments, insurance organizations and government departments are finding this pocket-sized book a big help in their inspection work. The INSPECTION MANUAL is not only helpful to beginners in fire protection and fire prevention, but contains a selection of material which even experienced men will have frequent occasion to consult.

Features of this easy-to-carry manual are: inspection procedure, what to look for in various occupancies, building construction and exits, common and special hazards, inspection of protective equipment, what "approvals" mean, how to make plans and reports.

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NATIONAL FIRE PROTECTION ASSN.
INTERNATIONAL
60 Batterymarch St., Boston 10, Mass.

Double trouble for fires ...extra economy for *you*

Inspected and listed under the Underwriters' Laboratories' Re-examination Service.

3% Aer-O-Foam® Liquid Proved Best by Actual Test

Aer-O-Foam snuffs out flammable liquid fires with a blanket of foam, quickly and efficiently. And to make it more economical than ever to use, the makers of Aer-O-Foam Liquid offer this product in 3% concentrated form. Here's what that means to you:

1. **Lower cost per unit volume of foam**
2. **Lower freight charges**
3. **Less storage space needed**
4. **Less time spent in handling**

In 3% or regular 6% form, there's no better foam liquid than Aer-O-Foam.

check these figures

Here's how 3% Aer-O-Foam gives better performance

	Foam Expansion at 70°F. (Gallons of foam per gallon of solution)	Minimum Operating Temperature*, 0°F.	FIRE TEST in accordance with nationally recognized standards				
			Coverage (Minutes)	Control (Minutes)	Extinguishment (Minutes)	Vapor Sealing Ability (Minutes)	Burn-Back Area** (Inches square)
3% Aer-O-Foam Liquid	10.25	0	0.80	1.66	2.25	20.0	10
Brand "Y"	9.00	6	1.33	4.00	4.33	6.5	19
Brand "Z"	8.50	14	2.50	4.33	5.17	2.0	30

*Temperature below which foam liquid viscosity increases so that pick-up rate is too low

**A six-inch square hole is cut in blanket, reignited and permitted to burn for five minutes. The extent of increase of exposed surface is then measured

For further information, see your nearest National Foam distributor, or write to the address below.

NATIONAL FOAM SYSTEM, INC.
Headquarters for Foam Fire Protection
WEST CHESTER, PENNA.

NATIONAL FOAM SYSTEM
CONTINUOUS FOAM PRODUCTION

fishin' is fun . . .
with care on the run

Here's a fellow who enjoys complete relaxation. He knows his plant is safeguarded from fire . . . a short circuit, a stray spark, a forgotten cigarette or spontaneous combustion can't cut into production time, destroy valuable records or endanger the lives of employees.

You, too, can have this same peace of mind about fire by fully protecting your investment in materials, equipment and buildings with modern, approved C-O-TWO Fire Protection Equipment.

No matter what your property . . . factory, mill, warehouse, power station or research center . . . or a particular fire hazard such as spray booth, dip tank, pump room, electrical equipment enclosure or record vault . . . there is a type of C-O-TWO Fire Protection Equipment that gives you fast, positive action the instant fire strikes. Whether it's a C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguisher for an incipient fire, or a C-O-TWO Built-In High Pressure or Low Pressure Carbon Dioxide Type Fire Extinguishing System for total flooding an entire fire hazardous area . . . C-O-TWO means experienced engineering that assures you of the best type equipment for the particular fire hazard concerned.

For example, at many locations a C-O-TWO Combination Smoke Detecting and Fire Extinguishing System is a "must." The first trace of smoke in a protected area sounds an alarm . . . then fast, clean, non-damaging, non-conducting carbon dioxide blankets the fire, putting it out in seconds, before it spreads and causes extensive damage.

So, let an expert C-O-TWO Fire Protection Engineer help you in planning complete and up-to-date fire protection facilities now. Write us today for complete free information . . . our experience is at your disposal.

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

Affiliated with Pyrene Manufacturing Company

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

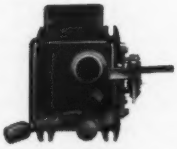
Kidde CO_2 Fire Extinguishing System Detects and Kills Fire Instantly!

Carbon dioxide is one of the fastest fire-fighters known—and here is one of the most effective uses for it . . . a *Kidde* built-in automatic system.

Increased temperature, from the first sign of fire, sets off a heat detector which automatically actuates a release connected to carbon dioxide gas cylinders. Instantly, fire-smothering CO_2 puts out the blaze . . . with no chance for human error. And, since CO_2 evaporates after doing its fire-smashing job, there's no damage to machinery or electrical equipment, and no after fire mess to ruin finishes.

Let Kidde solve *your* fire detection and protection problems. When you think of CO_2, call Kidde.

Heat Detector—Always alert, a heat detector goes into action at the first sign of fire. This one works on rate-of-rise principle, others on fixed-temperature.



Release—Actuated by the heat detector, this release causes valve mechanisms to operate letting CO_2 rush from the cylinders to the fire.

Multijet Nozzle—Kidde patented multijet nozzles decrease the CO_2 velocity without sacrificing volume—blanket flames gently, thoroughly.

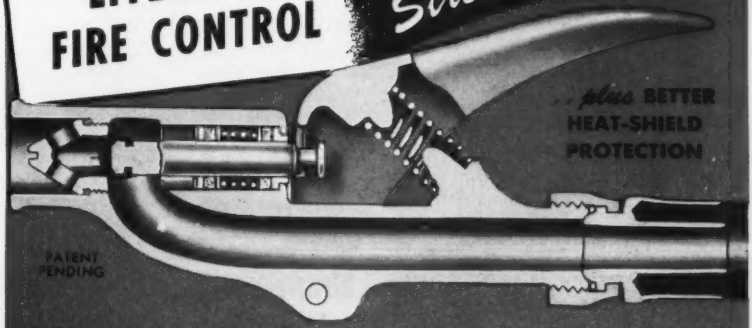
Kidde Extinguishers carry highest rating of Underwriters' Laboratories and The Factory Mutuals

Kidde

Walter Kidde & Company, Inc., 451 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

FASTER... MORE EFFECTIVE FIRE CONTROL

with the ANSUL *Stream Pattern*



Why Advertise the Nozzle! . . .

. . . because the nozzle on your ANSUL Dry Chemical Fire Extinguisher is water-tight . . . it won't become inoperative due to corrosion or caking of dry chemical within the working parts . . . the most inexperienced man in your plant can use the ANSUL extinguisher effectively . . . and only Ansul has a nozzle to meet all of these requirements!

If your hazards require special long range straight stream nozzles, you can get Ansul Extinguishers equipped with these nozzles at no extra cost. With Ansul Dry Chemical Fire Extinguishing Equipment you have not only the best fire protection but also a choice of models and designs to meet your requirements.

Exclusive Features — Water-tight construction. • Provides modified cone-shaped stream pattern without hole in the center of the stream. • Each nozzle gas pressure tested after assembly. • Special spring loaded packing to insure lasting water-tightness. • Designed for use by inexperienced operators. • Low velocity, more effective stream of dry chemical.

Send for File No. 653. You will receive our latest catalog, a Periodic Inspection Record Chart, "Fundamentals of Fire Extinguishment" and information about Ansul Dry Chemical Piped Systems for automatic protection.

ANSUL

CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION
MARINETTE • WISCONSIN

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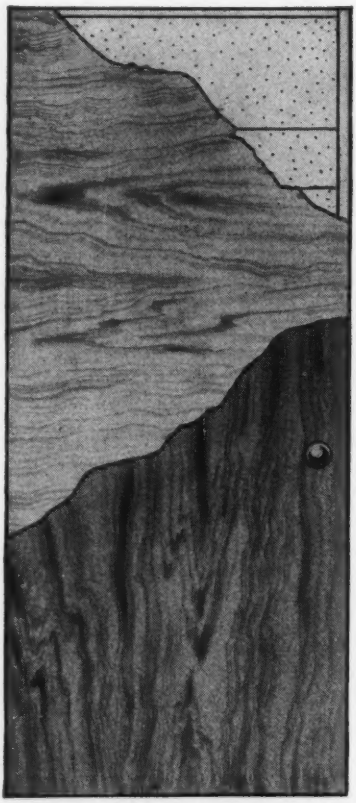
IN ALL PRINCIPAL CITIES IN THE U. S. A., CANADA AND OTHER COUNTRIES

"PLUS-FIFTY" DRY CHEMICAL IS MORE DEPENDABLE ALL-WAYS!

THIS TRADE MARK ASSURES YOU OF QUALITY PRODUCTS

Keep Fire Out with

Look at this practical construction:



Specifications:

WELDWOOD® FIRE DOORS, for use in Class "B" or lower classification locations, are approved by the Underwriters' Laboratories, Inc., and labeled accordingly. Available with or without 10″ x 10″ light openings, centered left to right in the door at eye level.

FACE VENEERS are thoroughly kiln-dried hardwood of standard thickness—1/28″—and smoothly belt sanded. Rotary cut unselect birch is standard; other sliced or rotary cut domestic or foreign woods are available.

THE KAYLO* CORE is an incombustible mineral composition having a nominal density of 20 pounds per cubic foot. The core sections are joined together with tongue-and-groove joints, as approved by the Underwriters' Laboratories, and smoothly sanded prior to application of crossbands and face veneers.

CROSSBANDS are thoroughly kiln-dried hardwood, 1/16″ thick and extending the full width of the door.

THE EDGE BANDING is of birch treated with Class "A" fireproofing agent. The top banding is ½″ thick; the side banding ¾″; and the bottom banding 1½″, made by laminating two ¾″ pieces.

WATERPROOF RESIN GLUE is used to bond the edge banding to the core.The entire core is sized two sides to insure perfect glue bond between core and crossband. The core, crossband and face veneer are bonded with waterproof Tego film phenolic glue by the hot plate process.

SIZES—The thickness of all Fire Doors is 1¾″. Available in range of standard sizes up to, and including, 4′ widths.

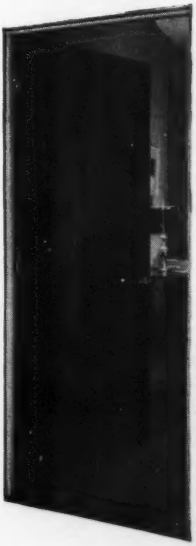
LOW HEAT TRANSMISSION

Weldwood Fire Doors have remarkable insulating qualities, maintaining reasonably low temperatures in the protected area so that heat cannot damage contents or start a new blaze. In a recent test the temperature of the unexposed face of a Weldwood Fire Door stayed down to less than 400° F. after one hour's exposure to flame; compared with almost 800° for a kalamein door and 1100° for a hollow metal door.

**T.M. Reg. Owens-Illinois Glass Co.*

WELDWOOD *FIRE* DOORS

. . . as BEAUTIFUL as they are safe!



Every door in the offices of Beatty & Oliver, Inc., 37 Wall Street, New York, is a Weldwood Fire Door.

600 Weldwood Fire Doors are used in the new office building at 505 Park Avenue, New York. In these days of ever-rising building costs, it's a big help to find such beautiful, practical doors available at moderate cost.

One of the attractive walnut Weldwood Fire Doors used throughout the Skouras Theatre Corp. Building in New York.

Weldwood Fire Doors provide assured fire protection with the beauty of fine wood paneling. Standard faces are birch veneers, but a wide variety of other handsome hardwood veneers is available on special order. Weldwood Fire Doors are durable, vermin- and decay-proof and are guaranteed against warpage and dimensional changes.

When planning hospitals, hotels, schools, offices, apartment houses and institutions, be sure they have the protection and beauty which these doors offer.

WELDWOOD FIRE DOORS

Manufactured and distributed by

UNITED STATES PLYWOOD CORPORATION

55 West 44th Street, New York 18, N. Y.

Branches in Principal Cities • Distributing Units in Chief Trading Areas • Dealers Everywhere

FOR *Essential*
PLANT PROTECTION

PITTSBURGH • DES MOINES

ELEVATED STEEL TANKS

An ever-ready supply of water at dependable pressure contributes greatly to plant security. When a modern Pittsburgh-Des Moines Elevated Steel Tank stands guard over your plant, fire protection problems are lessened, lower insurance rates are gained, better water service is a continual benefit. *Write for our latest 24-Page Elevated Tank Brochure.*

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When you buy a valve, you buy pipe-line control—which encompasses valve design, construction, operation, first cost and maintenance. Purchase-price alone is not the determining factor. Price is relative. A high quality valve having longer life and giving better pipe-line control always is lowest in final cost.

M & H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

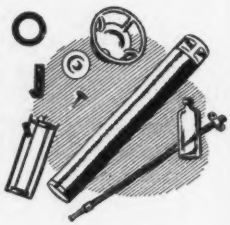
DEPENDABLE SERVICE— YEAR AFTER YEAR!

Field reports establish the fact that M & H Valves are correctly designed, dependable in operation, with a record of long life and freedom from repair. Engineers recommend M & H Valves on basis of low cost per year of service. Sizes 2 to 30 inch, inclusive, with all standard end connections, including Mechanical Joint.

COMPLETE INFORMATION ON REQUEST

M&H PRODU *Everywhere*

IMMEDIATE EXCHANGE
of repairable 1 and 1½ qt. Pyrene Vaporizing Liquid Extinguishers for factory-rebuilt models in perfect condition.



COMMON REPLACEMENT PARTS
for foam, soda-acid, cartridge-operated, and other Pyrene Extinguishers.

TRADE-INS
of old or damaged extinguishers of any make (Underwriters' Laboratories-approved) for brand-new Pyrenes!

Instant extinguisher service at Pyrene Service Depots!

Get parts and replacement extinguishers immediately. No waiting!

Millions of Pyrene* Fire Extinguishers have totaled many millions of years of service. Eventually all extinguishers become old, worn or damaged. When an extinguisher needs to be repaired, you don't want to be without protection while you wait for service from the factory.

Now 180 Pyrene Service Depots, located in leading cities, eliminate such dangerous delays. They'll immediately exchange your repairable 1 and 1½ qt. Pyrene Vaporizing Liquid Extinguishers for factory-rebuilts. They'll trade in non-repairable ones of any U.L.-approved make on new Pyrenes. And they'll supply common replacement parts and recharges for all types of 2½ gal. Pyrene Extinguishers.

Pyrene makes a *complete* line of extinguishers for every hazard—everything from hand-operated models to large automatic systems. Write for addresses of your local distributor and service depot.

*T.M. Reg. U.S. Pat. Off.

At this sign you will find a Pyrene for every fire hazard

PYRENE MANUFACTURING COMPANY
582 Belmont Avenue Newark 8, New Jersey
Affiliated with C-O-Two Fire Equipment Co.

NONCOMBUSTIBLE

OWENS-CORNING FIBERGLAS INSULATING FORM BOARD

for Fire-Safe Gypsum and Concrete Roofs

Made of ageless fibers of glass, Fiberglas* Form Board will not burn or support combustion.

Weighing but .87 lb. per square foot, this board imposes negligible dead weight on the structure. It has excellent thermal and noise reduction characteristics. It can be spray-painted without alteration of its properties. Applied only by authorized contractors, Fiberglas Form Board is a practical roof material of enduring fire safety.

OWENS-CORNING FIBERGLAS CORPORATION

Dept. 117-D **Toledo 1, Ohio**

FIBERGLAS IS IN YOUR LIFE...FOR GOOD!

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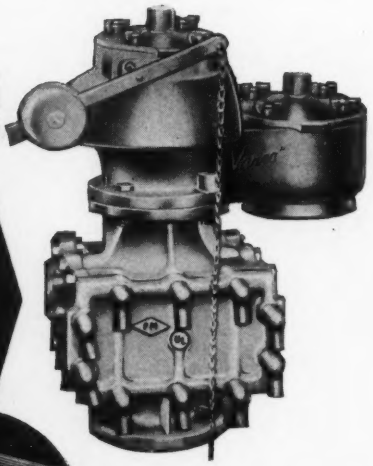
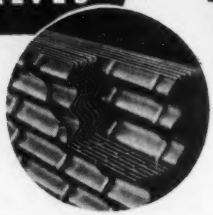
WHEN STORING FLAMMABLE LIQUIDS IT PAYS TO BE

EXTRA Safe

with "Varec" FLAME ARRESTERS In combination with your VENT VALVES





"VAREC" Fig. No. 5800 Vent Unit consisting of "VAREC" Conservation Vent Valve in combination with "VAREC" Flame Arrester.

The belief that conservation vents or breather valves alone will prevent travel of flame back into flammable liquid storage tanks is questionable because of the many contributing factors. Careful authoritative analysis reveals that valves by themselves do provide *some protection* but this "protection" *is by no means adequate* under all circumstances.

Safety authorities emphatically advise that "vent valves are not regarded as providing the required protection against fire and explosion." A textbook on safety states that "a conservative policy is to provide flame arresters in conjunction with other vent equipment on all cone-roof atmospheric tanks handling oils with a flash point up to 200°F open cup."

"VAREC" Flame Arresters when used as a unit with "VAREC" Vent Valves give you full fire protection at extremely low cost. Average installations run approximately .1 of 1% of your investment in tank and products. Consult your nearest "VAREC" representative or write for further information.

THE VAPOR RECOVERY SYSTEMS COMPANY

COMPTON, CALIFORNIA, U. S. A.

Cable Address: VAREC COMPTON USA (All Codes)

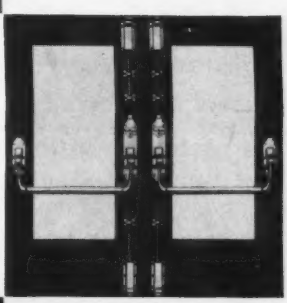
PROVED and APPROVED "Varec"

NF-1

Get your exits

ready for increased traffic

Call in your



Von Duprin

"EXIT ENGINEER"

● Increased production for your plant means more employes, more traffic, more need than ever for safe, dependable exits. Call in your Von Duprin "Exit Engineer" now for a free survey of your exit requirements. From actual experience, he can recommend the right Von Duprin exit devices to give you the greatest safety and service. Von Duprin is the most complete line of approved exit devices. From this one line, you can meet *all* your present and potential exit hardware needs. If you don't know the name of your nearest "Exit Engineer," write Von Duprin.

Free! Reserve a showing of Von Duprin's 20-minute sound movie, "Safe Exit." Build a lively safety program around this interesting public service film. Write for a booking.

VONNEGUT HARDWARE CO. • VON DUPRIN DIVISION • INDIANAPOLIS

Von Duprin

Fire and Panic EXIT DEVICES

THE SAFE WAY OUT!

"Eternal Vigilance"

—THE PRICE OF SECURITY!

WHETHER IT BE NATIONAL OR INDIVIDUAL PERFORMANCE . . . SECURITY IS ACHIEVED ONLY BY THE EVER-ALERT, EVER-CAPABLE AND EVER-DEPENDABLE!

All of these requisites for SECURITY against loss of life and property by fire are provided through the "ETERNAL VIGILANCE" of

STAR AUTOMATIC SPRINKLERS

Automatic Sprinklers
Corrosion-Proof Sprinklers
Directional Flow Sprinklers
Open Sprinklers
Spray Sprinklers
Alarm Devices

Automatic Releases
Standard Wet Pipe Systems
Dry Pipe Systems
Deluge Systems
Heat-Actuated Devices
Pre-Action Systems

Star Automatic Sprinklers and Fire Protection Devices bear approval of all Insurance Authorities having jurisdiction and various Governmental Agencies.

Economy in installation cost and maintenance has dictated the consistent policy of Star Sprinkler Corporation in distributing its Fire Protection Devices through local licensed contractors who have had a lifetime of experience in the installation of automatic sprinkler systems. Operating throughout the United States, Canada and South America, Star licensees, due to their strategic locations, can render instant service. Write us for name and address of Star licensed contractor nearest your location.

STAR SPRINKLER CORP.

Westmoreland and Collins Sts. — Philadelphia, Pa.

microfilm needs Extra protection

Should fire strike tomorrow, would your microfilm survive to help you resume business?

These are your most vital records . . . on lasting microfilm for permanent retention. HOW SAFE ARE THEY?

DID YOU KNOW THAT microfilm is even more vulnerable to fire and water than your paper records?

Our Record Protection Engineers have made a special report on microfilm protection, a copy of which will gladly be sent to you without cost.

Write for this free booklet: PROTECTION OF MICROFILM RECORDS AGAINST LOSS BY FIRE.

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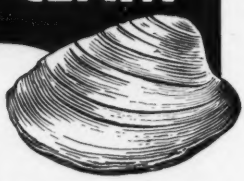
members of

SAFE MANUFACTURERS NATIONAL ASSOCIATION, Inc.

366 MADISON AVE. NEW YORK 17, N. Y.

Closes LIKE A CLAM—



HERE is an internal safety valve for L.P.G. truck tanks that adds materially to the safe transport and handling of butane and propane. The valve can be opened only by calculated, willful physical energy applied to the hydraulic operator, which is part of the safety valve system. When the hydraulic pressure is released, the valve closes like an irritated clam and is held closed by continuous spring pressure.

In highway accidents which tear the tank from the truck chassis and sever the hydraulic lines, the S. & J. Safety Valves remain closed, preventing any escape of gas and incident fire hazard. When fires occur during unloading, tiny fusible plugs inserted into tees in the hydraulic lines, melt at 165° F. and release the hydraulic pressure which is holding the safety valves open. They close instantly, adding no further fuel to the flames.

Just a couple of strokes on the handle of the S. & J. Hydraulic Operator shown at left, pumps the necessary hydraulic pressure to open the safety valve. Pressure is also released by the pump handle.

S&J

Listed by Underwriters Laboratories, the S. & J. Internal Safety Valves for L.P.G. truck tanks are available in ¾", 2" and 3" sizes.

Shand and Jurs Co. 917 CARLTON STREET • BERKELEY • CALIFORNIA

NEW YORK CHICAGO HOUSTON TULSA LOS ANGELES SEATTLE

In The Background Till Fire Strikes

Fits in smoothly with the most modern interiors. Barely visible, but ready at a second's warning to spring into action. Viking Flush Type Sprinkler Heads offer great *dependability*, plus true functional design. Get all details today from the *Viking* representative in your neighborhood.

THE VIKING FLUSH TYPE SPRINKLER HEAD

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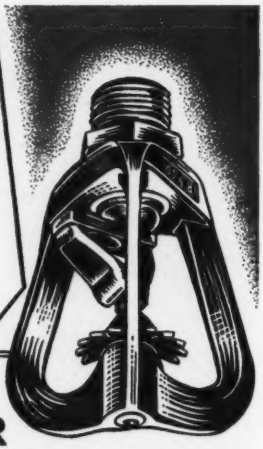
Pittsburgh, Pennsylvania

Viking Automatic Sprinkler Co.
Seattle, Washington
Portland, Oregon
Vancouver, B. C.

THE VIKING CORPORATION
HASTINGS, MICHIGAN

Another ROCKWOOD first



BETTER USE OF WATER FOR QUICKER FIRE EXTINGUISHMENT

Before World War II, Rockwood made water more efficient in extinguishing fire by the development of WaterFOG.

Portable WaterFOG Nozzles and Fixed Piping Installations were developed to extinguish fires in flammable liquids and materials. Then it developed that this method of breaking up water was effective in Class "A" fires (ordinary combustibles).

The High Capacity Fog Nozzle and the regular WaterFOG Nozzle were adopted by both the Navy and Municipal Fire Departments with outstanding success.

The T-Head is one further step in this development of more efficient use of water in fire extinguishment. This development will revolutionize sprinkler protection.

What is the T-HEAD!

The Rockwood T-Head is engineered and designed for use in fixed piping systems. It has a directional wide angle, medium velocity discharge and is installed in a pendent position. It is recommended for automatic as well as open deluge use.

This head can be used either as a sealed or open head. The sealed head combines the principles so successfully developed in WaterFOG with the sturdy time tested construction of the figure 4 fusible element of the regular Rockwood Sprinkler Head.

It has a full sized opening for the discharge of water. The design of the T-Head breaks up the water into a fog pattern fine enough to completely fill the area from the ceiling down to the floor and heavy enough to drive the particles down to any fire on the floor.

If the fire starts on the floor, the hot gases mushroom up in an inverted cone. The nearer the ceiling, the wider the cone. This head has a wide angle distribution without voids in the area near the ceiling. It prevents gas and flame from rising and also prevents them from mushrooming and needlessly opening adjacent heads.

The Rockwood T-Head is approved by Factory Mutual Laboratories and listed by Underwriters' Laboratories Inc.

Write today for new illustrated T-H sales folder.

The T-Head that will Revolutionize Sprinkler Protection!

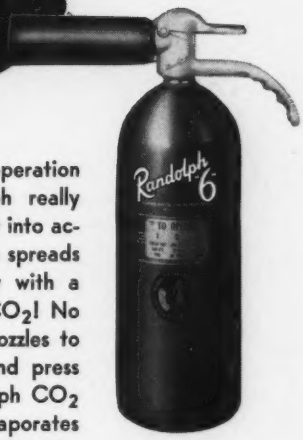
ROCKWOOD

ROCKWOOD SPRINKLER CO.

56 HARLOW STREET WORCESTER 5, MASS.

Experienced Engineering • Specialized Manufacturing • Expert Installation

You know how to operate this extinguisher ... JUST BY LOOKING AT IT!



2½ and 4 lb. Models. Famous "one hand" instant operation.

Simple, *obvious* operation makes the Randolph really panic-proof—gets it into action *before* the fire spreads—kills fire instantly with a snowy cloud of CO_2! No valves to turn, no nozzles to adjust; just point and press your thumb! Randolph CO_2 is non-damaging, evaporates without a trace. It's non-toxic, won't conduct electricity, deteriorate or freeze.

25 lb. Model. Mobile defense against severe, large-area fires. One man operation.

UNDERWRITERS' APPROVED — COMPLETE LINE OF EXTINGUISHERS AND SYSTEMS. Learn how Randolph gives your plant better preventative fire protection! Write or wire:

RANDOLPH Laboratories, Inc.,
24 E. Kinzie St., Chicago 11, Ill.

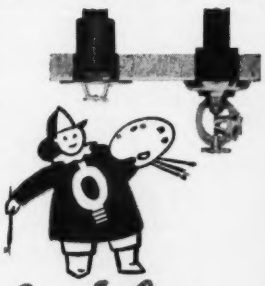
15 lb. Model. Self-balanced extra range and capacity.

10 lb. Model. Long-range hose and nozzle, easily portable.

Randolph
SIMPLIFIED FIRE EQUIPMENT

The development of the *Automatic* 400" **Ceiling Sprinkler** discounts the adage that you can't have beauty and fire protection too. For here is a sprinkler head that is designed to blend perfectly with the appointments of the most tastefully designed interior—finished in bronze or chrome, bright or satin, it projects less than one inch below the ceiling surface. Yet, regardless of its beauty, it's ready, willing and able to automatically extinguish fire whenever called upon to do so.

You'll find the *Automatic* 400" **Ceiling Sprinkler** installed in the most distinctively decorated offices, stores, restaurants and public buildings. No longer is it necessary to sacrifice "eye appeal" in order to have fire protection that offers both safety and savings.



Contact our nearest *Automatic Sprinkler* representative for engineering counsel, surveys and estimates. They are available to you without obligation. Ask for free literature.

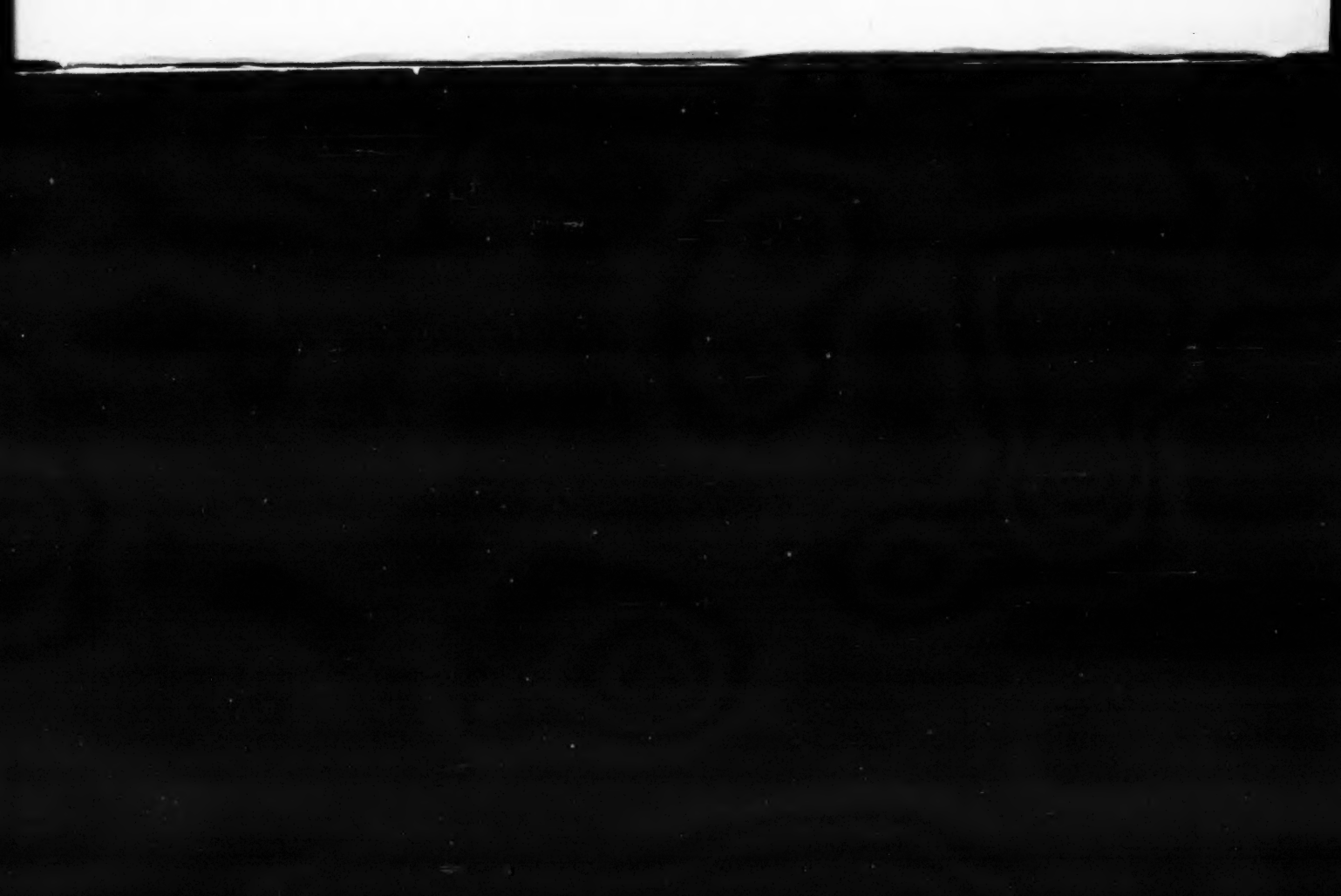
"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN 1, OHIO

"Automatic" Sprinkler

FIRST IN FIRE PROTECTION

DEVELOPMENT . ENGINEERING MANUFACTURE . INSTALLATION

OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA



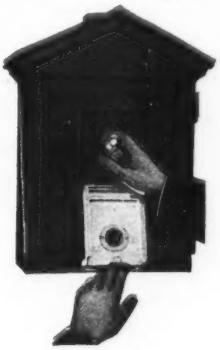
GAMEWELL

Municipal Fire Alarm Systems

Until the Fire Department knows there is a fire — and the exact location— it can do nothing about it.

For the protection of the values at risk — human life, property, business and income — adequate fire alarm box distribution is a sound investment.

The Standard Municipal Box



GAMEWELL Three-Fold Type

INDUSTRIAL FIRE ALARM SYSTEMS

We also supply complete systems for industrials and institutions. Write for our catalog descriptive of the Vigilarm System of Automatic Fire Detection.

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DEFENSE PRODUCTION
without interruption!

Defense production, with its challenging goal, is rapidly gaining momentum. Critical raw materials are being allocated. Industry is fast turning out strategic supplies to safeguard America and democracy against aggression throughout the world. Speed in production, without interruption, is vital.

The surest way to prevent interruption by fire is to install Grinnell Automatic Sprinklers. For over 70 years they have proved to be the most dependable defense against fire. Today they are protecting many industries engaged in defense production.

There is a type of Grinnell Fire Protection System for practically every fire hazard. Information is available for the asking from any of our offices in principal cities. Grinnell Company, Inc., 277 West Exchange Street, Providence 1, R. I.

GRINNELL SYSTEMS

For Protection Against Fire